SUPPLEMENTAL WORK PLAN

EAST FORK ABOVE LAVON WATERSHED

OF THE TRINITY RIVER WATERSHED
COLLIN AND GRAYSON COUNTIES, TEXAS

Prepared By
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Temple, Texas
SEPTEMBER 1963

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United States
Department of
Agriculture
National Agricultural Library

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT

between the

Collin County Soil Conservation District
Local Organization

Upper Elm-Red Soil Conservation District
Local Organization

Collin County Commissioners Court
Local Organization

Grayson County Commissioners Court
Local Organization

City of Van Alstyne
Local Organization

State of Texas
(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for East Fork Above Lavon Watershed, State of Texas, executed by the Sponsoring Local Organization named herein and the Service, became effective on the 12th day of September, 1956; and

Whereas, in order to carry out the watershed work plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement to provide for installation, operation, and maintenance of works of improvement; and

Whereas, it was found necessary to modify the watershed work plan to increase stream channel improvement from 6.4 miles to 37.29 miles; increase the floodwater retarding structures from 71 to 74; and add one multiple-purpose structure which will permit the addition of non-agricultural water management as a project purpose; and

Whereas, a Supplemental Watershed Work Plan which modifies the Watershed Work Plan dated August, 1956, for said watershed has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service, which plan is annexed to and made a part of this agreement; and

Whereas, the Counties will benefit from installation of works of improvement through the reduction of damages to property, including county roads and bridges

located in the flood plain of the watershed; and the City of Van Alstyne will benefit from installation of the multiple-purpose structure as a municipal water supply and recreational development. Therefore, the Collin County Commissioners Court, the Grayson County Commissioners Court, and the City of Van Alstyne agree to become sponsors of the watershed project.

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the Supplemental Work Plan, and further agree that the works of improvement as set forth in said plan can be installed in about 8 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the Supplemental Watershed Work Plan:

1. The Sponsoring Local Organization will acquire such lands, easements, or rights-of-way as will be needed in connection with works of improvement. (Estimated cost $592,120).

   The percentages of this cost to be borne by the Sponsoring Local Organization as provided in the attached work plan and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Cost (dollars)
Multiple-Purpose Structure No. 41 and Basic Recreational Facilities			
Payment to landowners for 292 acres 1/ and cost of relocation or modification of improvements.	56.69	43.31	58,880
Legal Fees, Survey Costs, and Other Costs	100.00	0	4,340
All Other Structural Measures	100.00	0	528,900 2/

1/ 289 acres fee simple title and 3 acres flood easements.
2/ Includes $11,100 legal fees.

2. The Sponsoring Local Organization in accordance with the Supplemental Work Plan will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
Multiple-Purpose Structure No. 41	22.57	77.43	147,610
Basic Recreational Facilities	50.00	50.00	16,640
Municipal Outlet Structure	100.00	0	13,560
Single-Purpose Floodwater Retarding Structures and Stream Channel Improvement	0	100.00	3,615,182

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service as provided are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Installation Service Cost (dollars)
Multiple-Purpose Structure No. 41	18.17	81.83	28,730
Municipal Outlet Structure	100.00	0	2,640
Basic Recreational Facilities (By Consulting Firm)	50.00	50.00	3,560
Single-Purpose Floodwater Retarding Structures and Stream Channel Improvement	0	100.00	837,850

5. The Service will award and administer the contracts covering the construction of all works of improvement. The contract administration costs for multiple-purpose structure No. 41, estimated to be 5 percent of the contract cost will be shared, the Sponsoring Local Organization bearing 18.17 percent based on the cost-sharing percentages for installation services.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the Supplemental Watershed Work Plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The Sponsoring Local Organization agrees that all land on which Federal assistance is provided will not be sold or otherwise disposed of for the evaluated life of the project, except to a public agency which will continue to maintain and operate the recreational development in accordance with the operation and maintenance agreement.

13. The Supplemental Watershed Work Plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

14. No member of Congress, or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Collin County Soil Conservation District
Local Organization

By J. S. Tulsey

Title Chmn

Date March 9, 1964

The signing of this agreement was authorized by a resolution of the governing body of the Collin County Soil Conservation District
Local Organization

adopted at a meeting held on March 9, 1964

[signature]
(Secretary, Local Organization)

Date March 9, 1964

Upper Elm-Red Soil Conservation District
Local Organization

By Harold Skaggs

Title Chairman

Date March 24, 1964

The signing of this agreement was authorized by a resolution of the governing body of the Upper Elm-Red Soil Conservation District
Local Organization

adopted at a meeting held on March 24, 1964

Keith Kemplin
(Secretary, Local Organization)

Date March 24, 1964

Collin County Commissioners Court
Local Organization

By Don Cowan Dunn

Title County Judge

Date 4-27-64

The signing of this agreement was authorized by a resolution of the governing body of the Collin County Commissioners Court
Local Organization

adopted at a meeting held on April 27, 1964

Jas. K Wells
(Clerk, Collin County)

By 4-27-64

Grayson County Commissioners Court
Local Organization

By Lis Tisdale

Title County Judge

Date 4-16-64

The signing of this agreement was authorized by a resolution of the governing body of the Grayson County Commissioners Court
Local Organization

adopted at a meeting held on April 16, 1964

Paul E. Lee
(Clerk, Grayson County)

Date 4-16, 1964

City of Van Alstyne
Local Organization

By Lorene K Gowan

Title Mayor

Date 5 6 64

The signing of this agreement was authorized by a resolution of the governing body of the City of Van Alstyne
Local Organization

adopted at a meeting held on May 5, 1964

Joyce Ashley
(Secretary, City of Van Alstyne)

Date May 6, 1964

Soil Conservation Service
United States Department of Agriculture

By _____

Date _____

SUPPLEMENTAL WORK PLAN

EAST FORK ABOVE LAVON WATERSHED
Of the Trinity River Watershed
Collin and Grayson Counties, Texas

Plan Prepared and Works of Improvement
to be Installed Under the Authority
of the Flood Control Act of 1944
as Amended and Supplemented

Participating Agencies

Collin County Soil Conservation District
Upper Elm-Red Soil Conservation District
City of Van Alstyne, Texas
Grayson County Commissioners Court
Collin County Commissioners Court

Prepared By:

Soil Conservation Service
U. S. Department of Agriculture
Sèptember 1963

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PREFACE

The East Fork Above Lavon watershed work plan was developed in 1956. The criteria used for evaluation of watershed projects have been refined and improved greatly in recent years. The Soil Conservation Service, with the assistance of U. S. Geological Survey and the Texas Water Commission, initiated a cooperative study in 1951, for the purpose of collecting and analyzing basic data on hydrology, geology and economics on the Honey Creek Tributary of this watershed.

Recent legislation broadened the authority of the Soil Conservation Service and provides an opportunity for broader participation by the sponsors in resource development in watershed projects. It was requested that the work plan be supplemented to provide opportunity for greater development of the watershed.

The evaluation procedures used in this supplemental work plan are based on the following factors:

1. Hydrologic conditions were considered using current criteria.

2. Current land use and crop distribution in the flood plain.

3. Without project conditions assumes no floodwater retarding structures installed.

4. Actual costs of construction and installation services were used for the 31 floodwater retarding structures constructed to date. The non-Federal installation costs for these 31 structures were adjusted to current prices. Installation costs for the 43 additional floodwater retarding structures are based on current prices.

5. The installation costs for structural measures were amortized at 3 percent interest for 50 years.

6. Annual benefits were based on 1962 prices adjusted to long-term level as projected by ARS, September 1957.

SUPPLEMENTAL WORK PLAN

EAST FORK ABOVE LAVON WATERSHED
Of the Trinity River Watershed
Collin and Grayson Counties, Texas
September 1963

INTRODUCTION

Authority

The East Fork Above Lavon Watershed Flood Prevention Project will be carried out under authority of the Soil Conservation Act of 1935 (Public Law No. 46, 74th Congress) and the Flood Control Act of 1944 (Public Law No. 534, 78th Congress), as amended and supplemented.

Purpose and Scope of Supplemental Work Plan

The purpose of this supplemental work plan is to modify and improve the system of structural measures and to provide municipal water storage and recreational development for the city of Van Alstyne as project purposes. It also provides for additional organizations to become sponsors.

SUMMARY OF PLAN
(As Supplemented)

The East Fork Above Lavon watershed consisting of an area of 220,810 acres (approximately 345 square miles) is located in Collin and Grayson Counties, Texas. The major land uses are cropland, 60 percent; pasture, 33 percent; and miscellaneous, 7 percent.

Sponsoring local organizations for this watershed project are:

Collin County Soil Conservation District
Upper Elm-Red Soil Conservation District
City of Van Alstyne, Texas
Collin County Commissioners Court
Grayson County Commissioners Court

The flood plain of this watershed covers 13,571 acres, excluding 1,082 acres of stream channels. Thirty-two major floods inundating more than half of the flood plain occurred during the 20-year period covered by the evaluation series.

There is a desire and need by the city of Van Alstyne, Texas, for municipal water supply and recreational development. The need for agricultural water management is minor. A multiple-purpose structure is proposed which will permit development of water-based recreational facilities and provide a municipal water supply for Van Alstyne.

Need for rural area development is minor in this area and was not given further consideration.

The trend in upland agriculture is toward diversified livestock farming and the conversion of the poorer and eroded cropland areas to pasture and hay production.

Land treatment measures are being established through the leadership of the two soil conservation districts, and it is estimated that these measures are approximately 56 percent applied. There is a need for accelerated technical assistance, and it is planned to use flood prevention funds in order to establish the planned measures at a faster rate.

It is estimated that $1,239,152 is needed to establish land treatment measures during the installation period. Of this amount, $80,000 is to be borne by Federal funds and $1,159,152 from other funds. To date, an estimated $2,341,539 has been expended for installation of such measures. Federal funds have borne $104,000 of this cost and other funds have borne $2,237,539 (tables 1 and 1A).

Structural measures to be installed during the 8-year installation period include 43 floodwater retarding structures, 37.29 miles of stream channel improvement, and 1 multiple-purpose structure (figure 8). It is estimated that the cost for installing these structural measures will be $5,257,892. Federal funds will bear $4,626,445 and other funds $631,447 (table 1).

To date 31 floodwater retarding structures have been installed at a cost of $1,711,109. Of this amount, $1,503,994 has come from Federal funds and $207,115 from other funds (table 1A).

Prior to the installation of any structural measures the estimated average annual flood damages amounted to $430,669 (table 5).

Average annual damage reduction benefits are expected to be $344,630 on the 13,571 acres of flood plain land, benefiting 398 landowners. Additional benefits from more intensive land use, secondary benefits, recreation, and municipal water supply will amount to $161,636.

The project will result in an 80 percent reduction in average annual area flooded and will provide an adequate water supply for municipal and recreational uses.

The average annual benefits from structural measures are expected to be $491,186 as compared to average annual costs of $289,535, giving a benefit-cost ratio of 1.7 to 1 (table 6).

It is expected that a major portion of the easements and rights-of-way will be donated for structural measures, except for the multiple-purpose structure. Contributions of services, labor, equipment, materials, and money

will be used whenever possible. The city of Van Alstyne will sell revenue bonds to provide its share of the funds needed in the installation of the multiple-purpose structure. Local sponsors do not plan to borrow funds for the development of this project.

Land treatment measures will be maintained by the landowners and operators of farms on which the measures are applied. County Commissioners Courts have authority and responsibility for the operation and maintenance of the structural measures. Sufficient moneys will be transferred annually to the Road and Bridge Funds for this purpose.

The city of Van Alstyne will be responsible for the operation and maintenance of the multiple-purpose structure, including recreational facilities. Funds for this purpose will be taken from city revenues, which may include income from recreational development.

The estimated annual operation and maintenance cost is $18,600, including $14,800 for the floodwater retarding structures and stream channel improvement, $300 for the multiple-purpose structure, and $3,500 for basic recreational facilities.

DESCRIPTION OF THE WATERSHED

Physical Data

East Fork Above Lavon watershed, exclusive of Lavon reservoir consists of an area of 220,810 acres (approximately 345 square miles), and is located in Collin and Grayson Counties, Texas. East Fork of the Trinity River rises near the town of Dorchester in Grayson County and flows in a southerly direction for approximately 50 miles, emptying into Lavon Reservoir in Collin County. The watershed ranges in width from 5 to 15 miles, averaging 9 miles. Honey, Whites, Hurricane, Throckmorton, and Clemons Creeks are the major tributaries to the main stem. Wilson, White Rock, and Ticky Creeks flow directly into Lavon Reservoir.

Topography ranges from nearly level to gently rolling with small localized areas of broken land. Elevation ranges from 495.5 feet above mean sea level at Lavon Reservoir to approximately 800 feet along the north watershed divide.

The watershed lies in the Blackland Prairie Land Resource Area. This rolling to nearly level prairie is underlain by Upper Cretaceous clays, marls, shales, and limestones of the Eagle Ford, Austin, and Taylor groups. These strata all dip gently to the southeast toward the Gulf of Mexico. The Eagle Ford group occupies 7 percent of the watershed area, the Austin 83 percent, and the Taylor 10 percent.

The major soil series found in the watershed are Houston, Houston Black, Hunt, Crockett, Wilson, Burleson, Trinity, Stephen, Austin, Lewisville,

Frio, and Eddy. These soils are fine textured, range from shallow to deep and are moderately to slowly permeable.

Physiographically, the watershed consists of a plain dissected by numerous streams which have cut shallow valleys. The stream channels are irregular in size, with wide and deep reaches alternating with shallow, sediment-filled reaches. In general, the size of the channel increases with the size of the drainage area on most of the tributary streams, while on the main stem of the East Fork there is little relationship between channel size and drainage area.

Approximately 205,556 acres are farmed, with the remainder in urban areas, roads, highways, stream channels, and other miscellaneous uses. An estimated 60 percent of the watershed is being used for crop production. Cotton, corn, and small grain are the principal crops. There are 13,571 acres of flood plain, excluding 1,082 acres in stream channels.

Land use in the watershed is estimated to be:

Land Use	Acres	Percent
Cropland	132,666	60.08
Pasture	72,890	33.01
Miscellaneous 1/	15,254	6.91
Total	220,810	100.00

1/ Includes roads, highways, railroads, towns, etc.

The hydrologic cover on pasturelands is fair to good. Cropland is used for row crops and small grains which provide a fair to good cover during the growing season. Proper management of crop residues provides a fair cover during other seasons of the year.

Temperatures range from 7 degrees below zero to 118 degrees above zero, with a mean annual temperature of 65.7 degrees Fahrenheit. The average date of the last killing frost is March 29 and that of the first killing frost is November 13, a normal frost-free period of 229 days.

The mean annual precipitation of 39.24 inches, based on a 54-year record at McKinney, is fairly well distributed throughout the year, with the greatest amounts of rainfall occurring in April and May. The minimum recorded annual rainfall was 20.76 inches in 1925 and the maximum was 76.12 inches in 1877. Individual rains of excessive amounts cause severe erosion and flood damage. Although these storms may occur during any season, the majority have occurred in the spring months.

Water for livestock and domestic uses on farms is supplied largely by shallow wells and small farm ponds. These sources, however, do not provide a dependable supply. Deep wells extending into the Trinity or Woodbine sands supply

most of the small towns and provide a supplemental supply for McKinney. The principal supply for McKinney is from Lavon Reservoir.

Economic Data

The economy of the watershed depends to a great extent on agricultural production. The watershed is characterized by intensive farming operations. The principal crops are cotton, corn, grain sorghums, small grains, alfalfa and other hay crops, and truck crops. Dairying is found throughout the watershed. Beef cattle production is carried out primarily with diversified farm operations.

There are approximately 1,065 farms in the watershed, with an average size of 192 acres. The current market price of land ranges from $150 to $225 per acre. Flood plain land is worth from $225 to $400 per acre, depending on location and accessibility. Land values are influenced by the proximity to the Fort Worth-Dallas metropolitan area. A majority of the farms are operated as an economical unit and are owned by the family living on the land.

Changes occurring in farm operations are toward more livestock, with an increase in feed and hay production such as alfalfa. The trend will continue toward larger operating units, with an increase in permanent pasture on the upland soils. The alluvial valleys will continue to be planted to high value crops.

The principal towns in the watershed and their populations (1960 Census) are:

City or Town	Population
McKinney (1962 estimate is 14,500)	13,763
Van Alstyne	1,608
Princeton	594
Howe	680
Anna	639

The population of McKinney has increased 60 percent during the 20-year period, 1940-1960, with most of the increase during the last 10 years.

The rural population of the watershed is estimated to be 8,800.

Principal industries in the watershed are: one of the largest cotton textile mills in the Southwest, employing 600 people; a trousers manufacturing company, employing 400 people; an automobile seat cover plant, employing 250 people; three meat packing companies; feed mills; cotton gins and compresses; ice cream and other milk products; breads and pastries; ladies' garments; mattresses and awnings; upholstery; and sausage sacks. A 329-bed Veterans Administration Hospital is located at McKinney.

About 1,720,000 people live within a 60-mile radius of McKinney. There are 8 major colleges, 8 major lakes, 2 major cities, 1,427 industries, and 15,984 business establishments within this area. Lavon Reservoir is the nearest water-based recreational facility.

The total agricultural income from Collin County averages about $18,000,000 annually. The watershed covers approximately 32 percent of the county. The counties in the watershed have not been designated as areas of underemployment under the Area Redevelopment Act.

Wheat and cotton are the principal crops in surplus supply being produced in the watershed. The acreage now devoted to these crops is significant to the watershed economy and to producers who depend upon these crops for a major portion of the family income.

The watershed is served by about 875 miles of roads, of which 240 miles are paved. U. S. Highway 75 and State Highways 24 and 121 cross the watershed. The Texas and New Orleans Railroad provides service to the area.

Land Treatment Data

The two soil and water conservation districts have been conducting a basic conservation program on the farms of the watershed for several years. This program, based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, is an essential part of watershed protection.

The watershed is served by Soil Conservation Service work units at McKinney and Van Alstyne. These work units, through their assistance to the soil conservation districts have aided landowners and operators in preparing 915 conservation plans on 124,681 acres within the watershed. Approximately 56 percent of the planned land treatment measures have been applied (tables 1 and 1A).

WATERSHED PROBLEMS

Floodwater Damage

The flood plain consists of 13,571 acres plus 1,082 acres of stream channels that will be inundated by the runoff from the largest storm considered in the 20-year evaluation series.

During this 20-year period, 1923 through 1942, there were 32 major floods that covered more than half of the flood plain and 52 minor floods covering less than half of the flood plain. There were 12 major and 27 minor floods during the months of April, May, and June, which is the season when crops and pastures are at a critical stage in growth and are very susceptible to damage from flood water.

East Fork and its tributaries, except those where floodwater retarding structures have been installed, flood frequently and cause high annual damage. The flood plain is wide and flat. A small rise above bankfull stage will cause large areas to be inundated. Cumulative area equivalent to the entire flood plain has been inundated on an average of 1.7 times each year. Floods develop rapidly and occur most often during the growing season.

Livestock are lost unless evacuation can be accomplished promptly.

Even though flooding is severe, farmers continue to use the flood plain intensively because of the high productive potential of the land. Fences and other improvements are difficult to maintain. This reduces diversified farming practices, especially in livestock farming, which in turn restricts the economical use of time and resources of the farmers.

Noxious weeds scattered by floodwater add to the cost of crop production.

The value of flood plain land is estimated to be $225 to $400 per acre, depending on location and accessibility.

Flooding causes interruption of traffic and damage to roads and bridges.

The most recent flood occurred in May 1963 when practically all the flood plain on the main stem and some of the tributaries was inundated. State Highway 24 near Princeton was closed for several hours. September 1962 was the next most recent flood which inundated most of the flood plain.

Based on the floods considered in the 20-year evaluation series, annual direct floodwater damages without the program of land treatment and structural measures in place are estimated to total $348,605. These damages, by individual evaluation reaches, are shown in the following table:

Annual Floodwater Damages Without Project

Evaluation Reach (Figure 7)		Floodwater Damages in Dollars (Based on Long-Term Prices)			
No.	Name	Crop and Pasture	Other Agricultural	Road and Bridge	Total
1	Lower East Fork Above Lavon Reservoir	56,732	16,888	17,598	91,218
1A	Clemons Creek	2,269	1,100	751	4,120
2	Middle East Fork	69,090	15,067	11,031	95,188
2A	Honey Creek	19,653	12,046	5,400	37,099
2B	Throckmorton Creek	3,506	764	893	5,163
2C	Hurricane Creek	995	183	123	1,301
2D	Whites Creek	2,589	281	258	3,128
3	Upper East Fork	8,062	1,527	1,163	10,752
4	Wilson Creek	58,122	14,686	10,763	83,571
5	Ticky Creek	9,736	5,130	2,199	17,065
	Total	230,754	67,672	50,179	348,605

Sediment Damage

Erosion in the upland area has resulted in the deposition of predominantly silty clay, with some clayey silt and sandy clay on the flood plain. These deposits are similar in texture and color to the original alluvium, but are lower in organic matter and plant nutrients. The internal drainage of much of the damaged land has been impaired by deposition of clays and silts. The productive capacity of 3,098 acres has been reduced from 10 to 20 percent, as follows:

Evaluation Reach	Acres Damaged				
	Pasture		Cropland		
	10 Percent	20 Percent	10 Percent	20 Percent	Total
1	312	25	425	64	826
1A	18	4	55	4	81
2	146	-	341	127	614
2A	171	48	150	33	402
2B	10	-	60	-	70
2C	13	-	43	-	56
2D	-	-	64	7	71
3	8	-	197	14	219
4	242	327	-	56	625
5	85	25	24	-	134
Total	1,005	429	1,359	305	3,098

Annual recovery of areas damaged by sediment deposition is approximately in balance with new damage.

The average annual monetary damage by overbank deposition is estimated to be $18,051.

Channel filling in the watershed has reduced channel capacities in the past, but aggradation has decreased significantly in recent years as a result of the application of land treatment practices.

An estimated 562 acre-feet of sediment is being deposited annually in Lavon Reservoir from East Fork of the Trinity, Wilson Creek, and Ticky Creek. The estimated annual damage to this reservoir by depletion of its capacity is $15,500.

Erosion Damage

Upland erosion rates range from 1.60 acre-feet per square mile annually for pastureland to as much as 5.80 acre-feet per square mile annually for isolated cropland areas. Sheet erosion accounts for 95 percent and gully and streambank erosion 5 percent of the annual gross erosion.

It is estimated that the productive capacity of approximately 611 acres of flood plain is being reduced 20 to 40 percent annually by scour. Flood plain erosion damage by evaluation reaches is as follows:

Evaluation Reach	Acres Damaged				
	Pasture		Cropland		
	20 Percent	40 Percent	20 Percent	40 Percent	Total
1	7	47	98	41	193
1A	10	1	18	3	32
2	-	5	70	28	103
2A	22	12	33	18	85
2B	5	7	-	6	18
2C	-	-	12	9	21
2D	-	-	17	6	23
3	-	-	40	11	51
4	25	-	23	13	61
5	20	-	4	-	24
Total	89	72	315	135	611

Indications are that damage by scour is equal to the rate of recovery.

The estimated average annual monetary damage by flood plain scour is $9,361.

Problems Relating to Water Management

Unorganized attempts have been made by individual landowners to levee bottom lands along the main stem of East Fork, Wilson Creek, and Honey Creek. These efforts, generally, have not proved to be satisfactory and the levees are not being maintained.

The city of Van Alstyne depends upon wells for municipal water, and a critical shortage would result with failure of the largest producing well. Such shortages retard industrial development, subject the city to potentially high losses from fire, and cause a curtailment in residential water use.

Needs for the multiple-purpose structure to supply municipal water to the city of Van Alstyne, have been examined by the city commission and it was determined by them that additional water supply is needed.

The city of Van Alstyne is interested in developing recreation facilities in connection with municipal water development in a multiple-purpose reservoir. There is a population in excess of 75,000 within a 25-mile radius of the proposed multiple-purpose reservoir. Several large reservoirs presently provide recreation for residents of this watershed and surrounding towns, but because of the large population to be served these facilities are often crowded during the summer season. A development is needed in this watershed

to make recreation more available to residents of the watershed and will contribute to relieving some of the crowded conditions at existing developments. A development of this size will be complementary to rather than competitive with, the major reservoirs.

Any needs for irrigation or drainage are minor and do not warrant further consideration in this study.

PROJECTS OF OTHER AGENCIES

Lavon Reservoir, constructed by the U. S. Corps of Engineers and into which this watershed drains, provides storage for flood control and municipal water supply. The planned works of improvement will prolong the life of Lavon Reservoir by reducing the rate of sedimentation. Structural and land treatment measures in this watershed will not materially reduce the water yield to the reservoir and will not produce any foreseeable detrimental effects to any other program which may be developed in the future. The planned modification of Lavon Reservoir has been considered in the development of this supplemental work plan.

There are no known plans by other agencies for additional works of improvements for water resource development above Lavon Reservoir which would affect or be affected by the program included in this supplemental work plan.

BASIS FOR PROJECT FORMULATION

The sponsoring local organizations asked that the East Fork Above Lavon Watershed Work Plan of 1956 be modified. The basis for the request was to include recreational and municipal water supply in a multiple-purpose structure and to maintain an acceptable level of protection from floodwater and sediment damages. It was agreed by the sponsors and the Service to plan a project that would:

1. Include land treatment measures based on current needs which can be applied during the project installation period and which contribute directly to watershed protection and flood prevention.

2. Provide for municipal water storage for the city of Van Alstyne.

3. Provide for the establishment of water-based recreational facilities.

4. Attain a reduction of at least 65 percent in average annual floodwater and sediment damages.

Alternate systems of structural measures were evaluated to obtain the most

economical system. Land treatment measures, floodwater retarding structures, stream channel improvement, and a multiple-purpose structure are the most feasible means of meeting project objectives.

Other objectives of the over-all watershed project are reduction of upland erosion and encouragement of owners to develop the structure sites as recreation areas.

In the selection of floodwater retarding structure sites, consideration was given to locations which would provide the desired level of flood protection. The location, size, number, and cost of structures were influenced by topographic and geologic conditions, existing roads, pipelines, powerlines, and farmsteads. Alternate combinations of structural measures including stream channel improvement which provided the desired level of flood protection were considered during development of the work plan. The most efficient system was used to meet the project objectives.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now being carried out by the Collin County and the Upper Elm-Red Soil Conservation Districts, is essential to a sound and continuing program of flood prevention in the watershed. Basic to the attainment of this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices. Emphasis will be placed on accelerating the establishment of those land treatment practices which have a measurable effect on the reduction of floodwater and sediment damages.

Trends in land use are toward conversion of poorer and eroded cropland areas to pasture and hay production.

The accelerated application and maintenance of land treatment measures is particularly important for protection of the 102,291 acres draining into planned floodwater retarding structures. The applied land treatment measures will reduce the sediment which would be delivered to the floodwater retarding structures. There are 118,519 acres of the watershed which do not have any control from floodwater retarding structures. On these lands, the establishment and maintenance of land treatment measures constitute the only planned measures. Land treatment measures are important in reducing scour damages on the 13,571 acres of flood plain.

Conservation cropping systems including such land treatment practices as cover and green manure crops, contour cultivation, and improved residue-conserving tillage operations will be established on approximately 30,290

acres of cropland. These farming practices will improve water-holding capacity, increase infiltration rate, improve fertility level, and reduce erosion of the soils. About 52 percent of the cropland area will be terraces (4,237,905 linear feet) and provided with needed grassed waterways to control erosion and retard runoff from the more rolling lands. Approximately 215,450 linear feet of diversions will be installed for protection from runoff originating in the steep pasture areas. Establishment of needed waterways will precede construction of terraces and diversions.

In this watershed the trend in upland farm areas is toward retirement of eroded areas from cropland use to hay or pasture. Proper use will be practiced on 28,690 acres of improved pasture. Approximately 9,020 acres of this area will be renovated by seeding and fertilizing. The remaining 19,670 acres will be improved or reestablished by either seeding or sodding to attain a good base grass cover. Special grazing control will be carried out and fertilizers applied as needed.

Brush and weed control will be carried out on 28,690 acres of pastureland. Distribution of grazing will be improved through the use of 1,148 farm ponds planned for installation on areas totaling 28,690 acres.

Application of wildlife area improvement measures, including fish stocking of farm ponds and sediment pools of floodwater retarding structures, will enhance upland game, fish and waterfowl habitats. Plantings in field borders and on grassland will furnish food and cover for wildlife. Excellent cover will be established within the fenced areas on the dams and emergency spillways and will furnish additional areas of wildlife habitat.

The installation of land treatment measures will reduce the total annual gross erosion in the watershed by approximately 15 percent. Infiltration will be increased by the improvement of cover in the cultivated areas and increased grass density and vigor in the pastured areas. Terraces, diversions, and waterways will slow the runoff from cultivated fields, and increased grass cover will utilize a maximum amount of the water from runoff-producing storms.

Structural Measures

The supplemental work plan provides for the deletion of previously planned floodwater retarding structures 1D, 25, 40, 49, and 54; adding floodwater retarding structures 3E, 26A, 26B, 29A, 32A, 35A, 38A, and 54A and 25.02 miles of stream channel improvement on the East Fork; increasing the stream channel improvement on Wilson Creek from 6.4 to 12.27 miles; and modifying floodwater retarding structure Site No. 41 to serve multiple purposes.

A total of 74 floodwater retarding structures, 1 multiple-purpose structure, and 37.29 miles of stream channel improvement are required to provide the desired protection to the flood plain lands (figure 8).

Thirty-one floodwater retarding structures have been constructed. These structures are identified in table 2 and on the project map (figure 8).

Figure 1 shows a section of a typical floodwater retarding structure.

The cost of installing these works of improvement, exclusive of basic recreational facilities, is as follows:

Floodwater Retarding Structures	$4,741,641
Multiple-Purpose Structure	246,515
Stream Channel Improvement	1,951,400
Total	$6,939,556

(table 2)

The capacity of the 74 floodwater retarding structures, together with the multiple-purpose structure, totals 59,846 acre-feet. Of this total, 15,156 acre-feet is provided for sediment accumulation over a 50-year period, 520 acre-feet for municipal water supply, 251 acre-feet for recreational development, and 43,919 acre-feet for floodwater detention. Runoff from 46 percent of the watershed will be retarded. This is an average of 5.15 inches from the area upstream from the structures, which is equivalent to 2.38 inches from the entire watershed. The amount of runoff controlled by each structure is shown in table 3.

All applicable State water laws regulating the appropriation of water or the diversion of streamflow will be complied with in the design and construction of structural measures.

Basic facilities for public recreational use will be installed at selected locations adjacent to multiple-purpose Site No. 41. They will include access roads, parking areas, boat launching ramps, boat docks, sanitary facilities, beach development, picnicking facilities, and camping areas. Schedule of the proposed facilities is shown in table A. The estimated installation cost of recreational facilities is $29,445 (table 2). Figure 6 shows the locations of these facilities.

The multiple-purpose structure contains 234 acres up to the maximum flow line, and the embankment and spillway will occupy an additional 15 acres. Water surface and land areas available for public recreational activities fluctuate with changes in the water surface elevation. The normal water surface area designated for recreational use is 75 acres. There will be 39 additional surface acres available at the maximum elevation of the conservation pool resulting from municipal water storage.

The land area above the maximum flow line to be purchased for development and use for basic public recreational facilities is 43 acres. An additional area of 120 acres between the maximum flow line and the top of the conservation pool may also be used for public recreational activities as water levels permit.

The improved stream channels are designed to carry the flow from an average 2-day storm producing a runoff of 2 inches from the uncontrolled area, plus release waters from the floodwater retarding structures. It is expected that flood plain lands will be protected from flooding on an average of 2 out of 3 years.

The total cost of structural measures, including basic recreational facilities, is estimated to be $6,969,001 (table 2), of which $1,711,109 have been expended (table 1A).

Details on quantities, costs, and design features of structural measures are shown in tables 1, 1A, 2, 3, and 3A.

EXPLANATION OF INSTALLATION COSTS

The estimated cost of planning and installing land treatment measures during the next 8 years, including expected reimbursement from Agricultural Conservation Program Service funds, is $1,239,152 ($2,341,539 expended to date) based on current program criteria. Technical assistance will be provided to landowners and operators through the soil conservation districts by the Soil Conservation Service at an estimated cost of $80,000 ($104,000 expended to date) from flood prevention funds. These land treatment costs are based on present prices being paid by landowners and operators to establish the individual measures.

Estimates of the kinds, amounts, and costs of land treatment measures were furnished by the Collin County and the Upper Elm-Red Soil Conservation Districts.

Land, easements, and rights-of-way for the single-purpose floodwater retarding structures and for stream channel improvement will be furnished by local interests at no cost to the Federal Government.

Reinforcing, underpinning, or reconstructing piers and abutments of existing county road bridges, necessitated by deepening of channels in connection with stream channel improvement, are considered as construction costs and will be borne by flood prevention funds. Such costs are limited to those required to provide a facility of comparable quality and performance capability to the existing bridge.

All other costs of bridge alterations are considered right-of-way costs and will be borne by local interests.

The local cost for the 74 floodwater retarding structures and 37.29 miles of stream channel improvement, estimated to be $736,015, consists of land, easements, and rights-of-way ($675,595), relocating and clearing obstacles ($37,680), and legal fees ($22,740). Local interests have expended $207,115 of this amount to date.

Construction costs for the 74 floodwater retarding structures and 37.29 miles of stream channel improvement, estimated to be $4,801,730, include the engineer's estimate and a 10 percent allowance for contingencies. The engineer's estimates were based on unit costs of structural measures constructed in similar areas and modified by special conditions inherent to each individual site location. The cost of installation services is estimated to be $1,155,296, including engineering and administrative costs. The total construction and installation services costs for these measures is $5,957,026 and will be borne by Federal funds, of which $1,503,994 have been expended to date.

The total cost of the single-purpose floodwater retarding structures and stream channel improvement for flood prevention is estimated to be $6,693,041.

Joint construction and installation services costs for the multiple-purpose structure, No. 41, were allocated by the Use of Facilities method, as follows:

Purpose	Acre-Feet	Percentages
Flood Prevention	2,090 1/	73.05
Recreational	251	8.77
Municipal	520	18.18
Total	2,861	100.00

1/ Includes 414 acre-feet of sediment storage.

All costs of legal fees, land easements, and rights-of-way and relocation and modification of existing improvements were allocated between municipal water supply and recreation. The percentage allocated to recreation was determined on the basis of the total area required for the dam and reservoir (249 acres) minus the reservoir area for the municipal water supply (39 acres) and divided by the total area for the dam and reservoir (84.34 percent). The remainder, 15.66 percent, was allocated to municipal water supply.

The municipal outlet structure is a specific cost and is allocated to municipal water supply.

Cost of minimum basic facilities and associated land was allocated to recreation as a specific cost.

The $176,340 joint (construction and installation services) cost was allocated, $15,461 to recreation, $128,819 to flood prevention, and $32,060 to water supply. The $16,200 specific cost for the municipal outlet structure was charged to water supply. All the costs of $29,445 for minimum basic facilities were allocated to recreation.

The cost for land, easements, and rights-of-way, legal fees, and relocation

and modification of existing improvements, $63,220, was allocated $54,766 to recreation, and $8,454 to water supply.

The cost allocated to recreation is $90,427, to water supply $56,714, and to flood prevention $128,819, for a total of $275,960 (table 2).

The sponsors' share of the cost of multiple-purpose structure No. 41 and minimum basic facilities is as follows:

	Percent of Total Cost	Estimated Sponsors' Cost (dollars)
Water Resource Facility		
Municipal Water Supply		
Construction		
Multiple-Purpose Structure	18.18	26,840
Municipal Outlet Structure	100.00	13,560
Installation Services 1/		
Multiple-Purpose Structure	18.18	5,220
Municipal Outlet Structure	100.00	2,640
Land, Easements, and Rights-of-Way	15.66	7,717
Relocations and Modification of Existing Improvements	15.66	157
Legal Fees 2/	18.18	580
Subtotal		56,714
Recreation Water Supply		
Construction	4.39	6,470
Land, Easements, and Rights-of-Way	42.17	20,781
Relocations and Modification of Existing Improvements	42.17	422
Legal Fees 2/	81.82	3,115
Subtotal		30,788
Minimum Basic Facilities		
Construction	50.00	8,320
Installation Services	50.00	1,780
Land, Easements, and Rights-of-Way	50.00	4,300
Legal Fees	100.00	645
Subtotal		15,045
Total Sponsors' Cost		102,547

1/ Includes $91 for administration of contract.
2/ Includes acquisition of water rights.

Federal funds will not bear any of the costs allocated to municipal water supply, or any legal fees or engineering services needed to obtain land, easements, and rights-of-way.

For the multiple-purpose structure Federal funds will bear the construction cost allocated to flood prevention ($107,830) and 50 percent of that allocated to recreation ($6,470), all the installation services cost allocated to these two purposes ($23,510), and 50 percent of the land costs ($20,781) and the cost of relocation and modification of existing improvements ($422) allocated to recreation.

The Federal share of basic recreational facilities is 50 percent of construction and installation services costs ($10,100) and associated land costs, excluding legal fees, ($4,300), (table 2). The Federal share of land, easements, and rights-of-way will be based on the actual payments made by the sponsors and not based on assessed or estimated values.

The Federal share of the multiple-purpose structure and minimum basic facilities is $173,413, of which $128,819 is for flood prevention and $44,594 is for recreational development.

The estimated schedule of obligations for the installation period for the supplemental work plan, including installation of both land treatment and structural measures, is as follows:

Fiscal Year	Measures	Flood Prevention Funds	Other Funds 1/	Total
		(dollars)	(dollars)	(dollars)
First	Floodwater Retarding Structures 1C, 1DA, 1E, 3E, 18 through 22, 26, 26A, 26B, and 27	689,582	92,280	781,862
	Land Treatment	10,000 2/	144,894	154,894
	Subtotal	699,582	237,174	936,756
Second	Floodwater Retarding Structures 35, 35A, and 36 through 39	353,101	48,670	401,771
	Multiple-Purpose Structure No. 41	159,013	87,502	246,515
	Recreational Facilities	14,400	15,045	29,445
	Stream Channel Improvement (Wilson Creek)	512,300	53,200	565,500
	Land Treatment	10,000 2/	144,894	154,894
	Subtotal	1,048,814	349,311	1,398,125
Third	Floodwater Retarding Structures 23, 28, 29, 29A, 30, 31, 32, 32A, 33, 34, 38A, and 48	699,409	99,080	798,489
	Land Treatment	10,000 2/	144,894	154,894
	Subtotal	709,409	243,974	953,383
Fourth	Floodwater Retarding Structures 6A, 6B, 8A, 8B, 17, 50 through 53, 54A, 55, and 56	908,440	139,970	1,048,410
	Land Treatment	10,000 2/	144,894	154,894
	Subtotal	918,440	284,864	1,203,304
Fifth	Stream Channel Improvement (East Fork)	1,290,200	95,700	1,385,900
	Land Treatment	10,000 2/	144,894	154,894
	Subtotal	1,300,200	240,594	1,540,794
Sixth	Land Treatment	10,000 2/	144,894	154,894
Seventh	Land Treatment	10,000 2/	144,894	154,894
Eighth	Land Treatment	10,000 2/	144,894	154,894
Total for Installation Period		4,706,445	1,790,599	6,497,044

1/ Includes reimbursement from ACP funds under going programs.
2/ Accelerated technical assistance.

This schedule may be adjusted on the basis of any significant changes in the plan found to be mutually desired and in the light of appropriations and actual accomplishments.

EFFECTS OF WORKS OF IMPROVEMENT

With the installation and operation of the project, 27 of the 32 major floods such as those which occurred during the 20-year evaluation period, 1923-1942, would be reduced to minor floods. Average annual flooding would be reduced from 23,112 acres to 4,915 acres in the benefited areas. Average annual flooding to depths greater than 3 feet would be reduced from 6,628 to 813 acres.

The following table illustrates the acres flooded by storms of specified frequencies without the project and with the complete project installed:

Agricultural Areas Inundated Below Site Locations

Evaluation Reach	Average Recurrence Interval					
	33 Percent Chance		10 Percent Chance		4 Percent Chance	
	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)
1	3,025	1,460	3,210	2,160	3,280	2,380
1A	205	57	220	100	230	135
2	2,800	1,060	2,930	1,820	3,030	2,170
2A	1,250	510	1,460	590	1,530	730
2B	177	84	240	115	300	130
2C	110	0	145	0	150	0
2D	175	0	245	0	280	1
3	500	62	700	125	810	250
4	2,520	860	2,760	1,450	2,840	1,730
5	495	330	520	370	535	400
Total	11,257	4,423	12,430	6,730	12,985	7,926

The following table shows the effects that the project will have on flooding and damages by evaluation reaches. All figures indicate average annual percent reduction.

Evaluation Reach (Figure 7)		Percent Reduction					
			Damages				
No.	Name	Acres Flooded	Crop and Pasture	Other Agricultural	Nonagricultural	Scour	Flood Plain Sediment
1	Lower East Fork Above Lavon	81	80	84	84	93	91
1A	Clemons Creek	77	73	90	90	91	90
2	Middle East Fork	80	79	85	85	88	91
2A	Honey Creek	67	67	94	96	84	86
2B	Throckmorton Creek	68	69	83	84	82	85
2C	Hurricane Creek	100	100	100	100	100	100
2D	Whites Creek	96	99	100	100	99	99
3	Upper East Fork	84	86	94	95	92	93
4	Wilson Creek	82	80	89	90	90	92
5	Ticky Creek	57	56	70	72	79	81
Total Watershed		80	78	87	87	90	91

The application of the planned land treatment program is expected to reduce the total annual gross erosion from 1,072 acre-feet to 912 acre-feet, a reduction of 15 percent. The annual flood plain scour damage on 611 acres is expected to be reduced about 90 percent. Four percent of this amount will be attributable to land treatment measures and 86 percent to structural measures.

After the complete project is installed, a 91 percent reduction in overbank deposition on 3,098 acres will be effected, with 17 percent resulting from land treatment measures and the remaining 74 percent from structural measures.

It is estimated that 562 acre-feet of sediment from this watershed is deposited annually in Lavon Reservoir under present conditions. This damage will be reduced to 311 acre-feet annually with the complete project installed.

Without the project, a 48-hour 25-year frequency storm will produce 5.21 inches of runoff from the watershed. Such a storm occurred in February 1938. This volume of runoff, under without project conditions, would produce a peak discharge of 31,000 cubic feet per second at the reference valley section No. 4E, and would inundate 13,571 acres of flood plain land below proposed floodwater retarding structure sites. The accelerated land treatment program will reduce the surface runoff from this storm to 5.10 inches (30,300 c.f.s.) and the area inundated to 13,482 acres. The installation

and full functioning of the floodwater retarding structures and stream channel improvement will further reduce the peak discharge to 15,300 c.f.s., and the area inundated to 8,833 acres.

Figure 3 graphically illustrates the reduction at valley section 6E for the storm of June 1941 (3.59 inches of rainfall, 3.02 inches of runoff), representing a storm of approximately 4-year frequency.

Reduced flooding will make it possible for farmers to increase the productivity of flood plain land to former levels and to organize cropping systems which will secure maximum returns. The flood threat from a recurrence of the storms in the evaluation series, would be eliminated from 4,738 acres. This will permit use of this fertile land to its full potential.

It is expected that intensified and changed land use will occur on about 2,380 acres of the flood plain. A large majority of this will be a change from Johnsongrass meadow, pasture, and woods to alfalfa and improved pasture, with some increase in truck crops. No significant change is expected on any crops under allotments or marketing quotas on the flood plain.

Landowners of flood plain lands will be able to carry out a more diversified and intensified agricultural program. Shifts in upland land use will reduce the acreage of cropland in the watershed by about 10,000 acres. The acreages in cotton and corn each will be reduced about 2,000. The wheat acreage will be reduced approximately 1,500. An estimated 398 landowners and operators will be benefited directly by the project.

The most severe damage is done to roads, bridges, and railroads by floods that cover 75 percent or more of the flood plain. With the project in place, the number of floods that would inundate 75 percent or more of the flood plain would be reduced from 11 to 0.

Percent of Flood Plain Covered	Number of Floods in 20-Year Series	
	Without Project	With Project
50 - 75	21	5
75 - 100	11	0

Some loss of wildlife habitat will result from the clearing of sediment pool areas at a limited number of sites, but all sites will offer opportunities for fish production. Wildlife use of the flood plain areas will be improved by reduction of frequency, depth, and duration of flooding.

The city of Van Alstyne will realize a saving in the development of its municipal water supply and recreation center by cooperating in the construction of Site No. 41 as a multiple-purpose structure.

The municipal water storage in the multiple-purpose structure will supplement the present source, provided by wells, which serves an estimated 1,620 people. The population of Van Alstyne is listed as 1,608 according to the 1960 census. It is expected that the city will grow, with an assured water supply, to a population of approximately 3,000 by the year 1990.

The recreation pool, with accompanying minimum basic recreation facilities, will provide opportunity for swimming, boating, fishing, water skiing, camping, and picnicking for an estimated 10,000 visitor days annually. Most intensive use will be from May to September, with peak daily use expected to reach 600 persons.

The sediment pools of the floodwater retarding structures in addition will provide neighborhood recreational opportunities that would not be available from any other source. Facilities will be available for recreational uses such as fishing, swimming, picnicking, boating, water skiing, camping, and hunting. Peak recreation use is expected to occur from May through September, with fishing and hunting continuing throughout the year. It is estimated that there will be an additional 7,500 visitor days annually with a peak daily use of 400 visitors.

The project will create additional employment opportunities for the local residents. The firms contracting for installation of the structures will hire a large percentage of the skilled and unskilled labor from the immediate locality. The operation and maintenance of project measures over the life of the project will also provide employment opportunities for the local residents.

Secondary benefits, including increased business activity and improved economic conditions in the surrounding communities, will result from the installation of the complete project. In addition, the increased farm production will provide an outlet for labor and for sale of products used in farm production. It will provide added income for farm families to improve their standard of living. Economic activities will be stimulated by sales of boats, motors, fishing and camping equipment, and other items associated with improved recreational opportunities. These secondary benefits will have a profound effect on the watershed and in the surrounding areas. In addition, there are intangible benefits such as increased sense of security and the opportunity to plan farm operations without consideration of frequent flooding. Local secondary benefits were considered to be equal to 10 percent of the direct primary benefits plus 10 percent on the increased costs that primary producers will incur in connection with increased production.

PROJECT BENEFITS

Total average annual benefits expected to result from installation of land treatment and structural measures are estimated to be $506,266, distributed as follows:

Benefits	Dollars
Damage Reduction	344,630
More Intensive and Changed Land use	88,432
Secondary	45,395
Recreation	18,750
Municipal Water	9,059

Agricultural (crop, pasture, other, erosion, sediment) and nonagricultural (road, bridge) damages, including indirect damages, will be reduced from an estimated $430,669 to $86,039 annually (table 5). Approximately 4.4 percent of the damage reduction benefits will result from land treatment measures; all the remainder will accrue to the structural program.

Annual net income will increase an estimated $88,432 to owners and operators of flood plain land from changed and more intensive land use (table B).

Local secondary benefits will accrue to workers, processors, handlers, and suppliers of additional goods and services that will be needed as a result of the project. These benefits are estimated to equal 10 percent of the direct damage reduction and recreational and municipal water benefits, plus 10 percent of the increased costs resulting from more intensive and changed land use. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

Benefits accruing from recreational use of multiple-purpose structure No. 41 are based on an estimate of 10,000 visitor days annually at a value of $1.50 per day.

Municipal water benefits are considered to equal the estimated cost of the least expensive equivalent alternative water supply. The annual benefits are estimated to be approximately $9,000.

Incidental recreation benefits (picnicking, swimming, fishing, boating, and hunting) based on an estimated net benefit of 50 cents per visitor day will equal $3,750 annually. These sites will be open for public recreational use with the landowner's permission.

COMPARISON OF BENEFITS AND COSTS

Primary benefits accruing to structural measures consist of reduction in damages, increase in income from more intensive and changed land use, and benefits from recreation and municipal water. These average $445,791 annually as compared to their annual cost of $289,535, giving a benefit-cost ratio of 1.5 to 1.

Total benefits, including secondary benefits, accruing to structural measures annually amount to $491,186, giving a benefit-cost ratio of 1.7 to 1 (table 6).

Wilson Creek, East Fork of Trinity, and Ticky Creek enter Lavon Reservoir independently of each other, and comparisons of benefits to costs are shown in table 6 for each unit.

The ratio of average annual primary benefits ($15,000) accruing to recreation in connection with multiple-purpose structure No. 41 to the average annual cost ($7,040) is 2.1 to 1.

The benefits from municipal water, estimated to be $9,059 annually, compared to its annual cost ($2,260) will give a benefit-cost ratio of 4.0 to 1.

PROJECT INSTALLATION

During the 8-year installation period land treatment measures will be installed by individual landowners through the leadership of the two soil conservation districts.

The County Agricultural Stabilization and Conservation Committee will cooperate with the governing bodies of the soil conservation districts in selecting those practices which will accomplish the conservation objectives in the most efficient manner.

The Texas Extension Service will assist in the general educational phase of the program by furnishing information to landowners and operators in the watershed.

In general, the multiple-purpose structure and the floodwater retarding structures will be constructed during the early part of the installation period.

Site No. 39, in series above the multiple-purpose site must be constructed prior to or simultaneously with structure Site No. 41. Basic recreational facilities will be installed concurrently with multiple-purpose structure Site No. 41.

Stream channel improvement planned for Wilson Creek tributary and the main stem of East Fork will be done after drainage area control needs have been satisfied. The various features of cooperation between the parties involved have been covered in appropriate memoranda of understanding and working agreements.

The Soil Conservation Service will contract for the construction of the 43 floodwater retarding structures, 37.29 miles of stream channel improvement, and the multiple-purpose structure. The Soil Conservation Service will prepare plans and specifications, contract for and supervise construction, prepare contract payment estimates, make final inspections, certify completion, and perform related tasks for the installation of the structural measures, including the municipal outlet structure. The city of Van Alstyne will reimburse the Soil Conservation Service for the city's share of the

construction and installation services costs (table 2).

The local sponsors will provide, at no cost to the Federal Government, all the land, easements, rights-of-way, roads, utilities, pipelines and other improvements, and their removal or relocation as needed for the construction of the floodwater retarding structures and stream channel improvement.

Land, easements, and rights-of-way necessary for the installation of the multiple-purpose structure (No. 41) and the basic recreational facilities will be furnished by the city of Van Alstyne, Texas. Payments for land, easements, and rights-of-way will be shared by the Federal Government and the city of Van Alstyne (table 2).

The legal cost incurred in acquiring land, easements, and rights-of-way for the recreational development will be furnished by the city of Van Alstyne.

The city of Van Alstyne will employ a consulting engineer for the construction and installation of the basic recreational facilities. The Soil Conservation Service will assist in the general layout and make inspections to insure that the facilities are installed as planned. The Service will reimburse the city of Van Alstyne for 50 percent of the payments made for construction and installation services, less the value of engineering services furnished by Service personnel.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement as described in this supplemental work plan will be provided under the authority of the Flood Control Act of 1944, as amended and supplemented.

The costs of applying land treatment measures will be borne by the owners and operators of the land. Flood prevention funds will be used for technical assistance in accelerating the application of conservation measures. Provision of Federal funds is contingent upon the local organizations meeting their obligations and upon appropriation of Federal funds for these purposes.

The structural measures will be constructed pursuant to the following conditions:

1. The requirements for land treatment in the drainage area above structures have been satisfied.

2. Land, easements, and rights-of-way have been secured for all structural measures or for a group of structures in a hydrologic unit, or written statements are furnished by the appropriate sponsoring local organization(s) that their rights of eminent domain will be used, if needed, to secure any remaining easements within the

project installation period, and that sufficient funds are available and will be used to pay for these easements, permits, and rights-of-way.

3. Project and operation and maintenance agreements have been executed.

4. Flood prevention funds are available.

5. Through the sale of revenue bonds, Van Alstyne, Texas, will provide its share of the funds needed in acquiring rights-of-way, construction of works of improvement, and for basic recreational facilities in the installation of Site No. 41 (table 2).

Funds to obtain land, easement, and rights-of-way, not otherwise donated, as may be needed for installation of floodwater retarding structure Site No. 39 will be provided by the city of Van Alstyne, Texas.

Contributions of land, easements or rights-of-way, materials, labor, equipment, services, and money will be used whenever possible. County funds also will be used where necessary. Landowners were contacted by the local sponsors during development of the work plan, and it is expected that the major portion of the easements and rights-of-way will be donated, except for the multiple-purpose structure Site No. 41.

Commissioners courts of the counties in which structural measures are located will exercise their power of eminent domain as may be needed to secure rights-of-way necessary for installation of structural measures.

The sponsoring local organizations do not plan to use a Farmers Home Administration loan for this project.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers in the area. Educational meetings will be held in cooperation with other agencies to outline the services available and eligibility requirements. Present clients will be encouraged to cooperate in the project.

The County Agricultural Stabilization Conservation Committee will cooperate with the sponsoring organizations by providing financial assistance for those land treatment measures which will meet the conservation objectives in the shortest possible time.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by the landowners or operators of

the farms on which the measures are installed. Representatives of the soil conservation districts will make periodic inspections of the land treatment measures to determine maintenance needs. Landowners and operators will be encouraged to perform the management practices and needed maintenance. District-owned equipment will be available for this purpose.

Structural Measures

The estimated annual operation and maintenance cost is $14,800 for the floodwater retarding structures and stream channel improvement, $300 for the multiple-purpose structure, and $3,500 for basic recreational facilities.

Specific operation and maintenance agreements will be executed prior to the issuance of invitation to bid on construction of any of the structural works of improvement included in this supplemental work plan.

Each year the County Commissioners Courts will transfer to the Road and Bridge Funds sufficient moneys for operation and maintenance of structural measures.

The city of Van Alstyne will be responsible for operation and maintenance of the multiple-purpose structure, including recreational facilities, in accordance with provisions as specified in the Operation and Maintenance Agreement. Maintenance will be accomplished through the use of contributed labor and equipment, by contract, by force account, or a combination of these methods. Funds to be used for operation and maintenance of the structure will be taken from city revenues which may include income from recreational development. Admission fees charged by the city will be limited to those necessary to amortize the initial investment and provide adequate operation and maintenance. These funds will provide for custodial, policing, sanitary, safety, liability insurance, and other operational services.

Maintenance funds will be used to repair or replace such items as boat docks, sanitary facilities, parking areas, roads, picnic equipment, equipment at the beach, renewal of the beach, and maintenance of safety equipment.

Preventive actions will be taken as necessary to correct conditions likely to result in damage to recreational facilities. In the event damages occur to the recreational facilities or equipment, prompt corrective actions will be taken in an effort to limit maintenance costs to the minimum.

The Grayson County Commissioners Court will be responsible for operation and maintenance of floodwater retarding structures Nos. 18, 19, 20, 21, 22, 23, 26, 26A, 26B, 27, 28, 35, 35A, 36, 37, 38, 38A, and 39. Maintenance will be accomplished through the use of contributed labor, by contract, by force account, or by a combination of these methods. The court will establish a permanent reserve fund to be used for operation and maintenance of the structural measures from tax revenue being collected by the county.

Responsibility for operation and maintenance of 37.29 miles of stream channel improvement and floodwater retarding structures Nos. 1A, 1B, 1C, 1DA, 1E, 2A, 2B, 3A, 3B, 3C, 3D, 3E, 4, 5A, 6A, 6B, 8A, 8B, 8C, 8D, 8E, 8F, 8G, 8H, 9, 10, 11, 12, 13, 14, 15, 16, 17, 24, 29, 29A, 30, 31, 32, 32A, 33, 34, 42, 43, 44, 45, 46, 47,48,50,51,52, 53, 54A, 55, and 56 will be assumed by the Collin County Commissioners Court. Maintenance will be accomplished through the use of contributed labor, by contract, by force account, or by a combination of these methods. A permanent reserve fund will be established for use in operation and maintenance of these structures.

The structural measures will be inspected jointly by representatives of the appropriate soil conservation district and county commissioners court or the city of Van Alstyne after each heavy streamflow. The Soil Conservation Service representative will participate in these inspections at least annually. For the floodwater retarding structures, items of inspection will include, but will not be limited to, the condition of the principal spillway and its appurtenances, the earth fill, the emergency spillway, the vegetative cover, and the fences and gates installed as a part of the structure. For the stream channel improvement, items of inspection will include, but will not be limited to, the degree of scour, channel filling, and bank erosion; obstructions to flow caused by debris lodged against bridges, fences, and watergates; excessive brush and tree growth within the channel; and the condition of side inlets and drains. The items of inspection are those most likely to require maintenance.

Representatives of the city of Van Alstyne, Texas, and the Collin County Soil Conservation District will inspect the recreational facilities and the multiple-purpose structure following each major storm, period of heavy use, any event likely to produce damage, or at least monthly. Inspections during the season of heavy usage will be made as often as necessary to prevent deterioration of the facilities. A representative of the Soil Conservation Service will participate in the inspections of the recreational facilities as often as may be required to assure their proper maintenance, but not less than once each year.

The Soil Conservation Service, through the Collin County and the Upper Elm-Red Soil Conservation Districts, will participate in operation and maintenance to the extent of furnishing technical assistance to aid in inspections and technical guidance and information necessary for the operation and maintenance program.

Provisions will be made for free access of representatives of sponsoring local organizations and Federal representatives to inspect and provide maintenance for all structural measures and their appurtenances at any time.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
Price Base: 1962

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) Federal 1/	Other 2/	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Acre	30,288	-	496,465	496,465
Pastureland	Acre	28,691	-	662,687	662,687
Technical Assistance (Accelerated)			80,000	-	80,000
SCS Subtotal		58,979	80,000	1,159,152	1,239,152
TOTAL LAND TREATMENT		58,979	80,000	1,159,152	1,239,152
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	43	2,087,082	-	2,087,082
Stream Channel Improvement	Foot	196,900	1,528,100	-	1,528,100
Multiple-Purpose Structure	No.	1	114,300	33,310	147,610
Municipal Outlet Structure	No.	1	-	13,560	13,560
Basic Recreational Facilities			8,320	8,320	16,640
SCS Subtotal			3,737,802	55,190	3,792,992
Subtotal - Construction			3,737,802	55,190	3,792,992
Installation Services					
Soil Conservation Service					
Engineering Services			527,918	5,390	533,308
Other			335,222	4,250	339,472
SCS Subtotal			863,140	9,640	872,780
Subtotal - Installation Services			863,140	9,640	872,780
Other Costs					
Land, Easements, and Rights-of-Way			25,503	551,177	576,680
Legal Fees			-	15,440	15,440
Subtotal - Other Costs			25,503	566,617	592,120
TOTAL STRUCTURAL MEASURES			4,626,445	631,447	5,257,892
Work Plan Preparation Cost			38,500	-	38,500
TOTAL PROJECT			4,744,945	1,790,599	6,535,544
SUMMARY					
Subtotal - SCS			4,744,945	1,790,599	6,535,544
TOTAL PROJECT			4,744,945	1,790,599	6,535,544

1/ Flood prevention funds.
2/ Includes reimbursement from ACP funds under going program.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(At time of Supplemental Work Plan Preparation)
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Price Base: 1962

Installation Cost Item	Unit	Applied To Date 1/	Estimated Cost (Dollars) Federal 2/	Other 3/	Total
LAND TREATMENT					
Soil Conservation Service					
Conservation Cropping System	Acre	60,575	-	72,048	72,048
Contour Farming	Acre	31,508	-	39,385	39,385
Cover and Green Manure Crop	Acre	16,154	-	161,154	161,154
Crop Residue Use	Acre	15,144	-	30,288	30,288
Hayland Planting	Acre	4,920	-	54,114	54,114
Pasture & Hayland Renovation	Acre	7,215	-	72,152	72,152
Pasture Planting	Acre	19,541	-	234,492	234,492
Pasture Proper Use	Acre	47,817	-	191,269	191,269
Rotation Grazing	Acre	23,908	-	47,816	47,816
Brush and Weed Control	Acre	35,991	-	71,982	71,982
Diversion	Foot	474,720	-	42,921	42,921
Farm Pond	No.	1,912	-	516,424	516,424
Grade Stabilization Structures	No.	47	-	39,582	39,582
Grassed Waterway or Outlet	Acre	2,530	-	278,411	278,411
Terrace, Gradient	Foot	8,051,920	-	366,226	366,226
Terrace, Parallel	Foot	423,785	-	19,275	19,275
Technical Assistance (Accelerated)			104,000	-	104,000
Subtotal			104,000	2,237,539	2,341,539
TOTAL LAND TREATMENT			104,000	2,237,539	2,341,539
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	31	1,186,548	-	1,186,548 4/
Subtotal - Construction			1,186,548	-	1,186,548
Installation Services					
Soil Conservation Service					
Engineering Services			208,714	-	208,714
Other			108,732	-	108,732
Subtotal - Installation Services			317,446	-	317,446
Other Costs					
Land, Easements, and Rights-of-Way			-	201,675	201,675
Legal Fees			-	5,440	5,440
Subtotal - Other Costs			-	207,115	207,115
TOTAL STRUCTURAL MEASURES			1,503,994	207,115	1,711,109
Work Plan Preparation Cost			48,300	-	48,300
TOTAL			1,656,294	2,444,654	4,100,948

1/ As of June 30, 1963.
2/ Flood prevention funds.
3/ Includes reimbursement from ACP funds under going programs.
4/ Actual contract cost.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION 1/
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
(Dollars) 2/

Constructed Prior to July 1963

Structure Site Number or Name	Installation Cost - Federal Funds: Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Federal	Installation Cost - Other Funds: Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Other	Total Installation Cost
Floodwater Retarding Structures											
1A	30,625	5,900	2,849	-	39,374	-	-	-	4,015	4,015	43,389
1B	32,509	7,509	3,024	-	43,042	-	-	-	6,885	6,885	49,927
2A	81,411	9,718	7,139	-	98,268	-	-	-	3,790	3,790	102,058
2B	29,490	4,880	2,810	-	37,180	-	-	-	4,110	4,110	41,290
3A	17,574	3,533	1,769	-	22,876	-	-	-	3,865	3,865	26,741
3B	40,985	5,458	3,687	-	50,130	-	-	-	9,190	9,190	59,320
3C	30,775	5,059	2,863	-	38,697	-	-	-	5,385	5,385	44,082
3D	24,621	4,849	2,346	-	31,816	-	-	-	4,315	4,315	36,131
4	64,919	7,597	5,693	-	78,209	-	-	-	11,015	11,015	89,224
5A	30,303	5,216	2,819	-	38,338	-	-	-	5,685	5,685	44,023
8C	46,625	6,205	4,195	-	57,025	-	-	-	7,995	7,995	65,020
8D	25,909	5,801	2,469	-	34,179	-	-	-	7,560	7,560	41,739
8E	56,758	7,721	5,107	-	69,586	-	-	-	7,905	7,905	77,491
8F	26,095	5,477	2,487	-	34,059	-	-	-	4,225	4,225	38,284
8G	64,660	8,444	5,670	-	78,774	-	-	-	12,955	12,955	91,729
8H	37,815	5,457	3,517	-	46,789	-	-	-	8,125	8,125	54,914
9	29,495	8,021	2,811	-	40,327	-	-	-	4,845	4,845	45,172
10	31,509	7,665	2,931	-	42,105	-	-	-	5,505	5,505	47,610
11	51,177	10,593	4,604	-	66,374	-	-	-	8,200	8,200	74,574
12	35,219	9,844	3,276	-	48,339	-	-	-	5,235	5,235	53,574
13	35,652	8,363	3,316	-	47,331	-	-	-	3,660	3,660	50,991
14	21,303	6,387	2,030	-	29,720	-	-	-	3,790	3,790	33,510
15	33,243	6,395	3,092	-	42,730	-	-	-	5,710	5,710	48,440
16	29,862	6,272	2,846	-	38,980	-	-	-	6,395	6,395	45,375
24	24,382	6,361	2,324	-	33,067	-	-	-	5,105	5,105	38,172
42	44,878	6,557	4,028	-	55,463	-	-	-	15,420	15,420	70,883
43	38,940	6,127	3,620	-	48,687	-	-	-	9,985	9,985	58,672
44	24,552	4,870	2,340	-	31,762	-	-	-	2,535	2,535	34,297
45	47,390	6,785	4,264	-	58,439	-	-	-	3,920	3,920	62,359
46	48,346	8,361	4,350	-	61,057	-	-	-	11,045	11,045	72,102
47	49,526	7,289	4,456	-	61,271	-	-	-	8,745	8,745	70,016
Subtotal	1,186,548	208,714	108,732	-	1,503,994	-	-	-	207,115	207,115	1,711,109

(See footnotes on last page table 2.)

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION 1/ - Continued
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
(Dollars) 2/

Installation Period - July 1963-July 1971

Structure Site Number or Name	Installation Cost - Federal Funds					Installation Cost - Other Funds					Total Installation Cost
	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Federal	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Other	
Floodwater Retarding Structures											
1C	50,204	9,126	4,519	-	63,849	-	-	-	9,175	9,175	73,024
1DA	55,869	9,267	4,556	-	69,692	-	-	-	5,820	5,820	75,512
1E	80,135	12,020	7,027	-	99,182	-	-	-	22,925	22,925	122,107
3E	22,924	5,731	2,185	-	30,840	-	-	-	3,520	3,520	34,360
6A	61,974	9,296	5,435	-	76,705	-	-	-	6,650	6,650	83,355
6B	96,657	14,500	8,476	-	119,633	-	-	-	9,500	9,500	129,133
8A	65,923	9,888	5,781	-	81,592	-	-	-	15,700	15,700	97,292
8B	76,912	11,537	6,744	-	95,193	-	-	-	16,690	16,690	111,883
17	46,780	7,402	3,663	-	57,845	-	-	-	7,300	7,300	65,145
18	52,040	9,460	4,682	-	66,182	-	-	-	8,390	8,390	74,572
19	28,735	7,184	2,739	-	38,658	-	-	-	7,520	7,520	46,178
20	33,586	7,389	3,124	-	44,099	-	-	-	4,450	4,450	48,549
21	29,107	7,277	2,774	-	39,158	-	-	-	2,270	2,270	41,428
22	39,050	8,591	3,633	-	51,274	-	-	-	2,370	2,370	53,644
23	79,580	11,937	6,978	-	98,495	-	-	-	31,720	31,720	130,215
26	61,380	9,207	5,382	-	75,969	-	-	-	13,400	13,400	89,369
26A	23,331	5,833	2,224	-	31,388	-	-	-	3,930	3,930	35,318
26B	21,461	5,365	2,045	-	28,871	-	-	-	3,610	3,610	32,481
27	38,400	8,448	3,572	-	50,420	-	-	-	4,900	4,900	55,320
28	33,060	7,458	3,154	-	43,672	-	-	-	4,920	4,920	48,592
29	31,020	6,824	2,886	-	40,730	-	-	-	5,050	5,050	45,780
29A	29,450	7,363	2,807	-	39,620	-	-	-	3,180	3,180	42,800
30	36,060	7,933	3,355	-	47,348	-	-	-	4,450	4,450	51,798
31	41,130	7,477	3,700	-	52,307	-	-	-	3,470	3,470	55,777
32	57,750	10,500	5,196	-	73,446	-	-	-	6,410	6,410	79,856
32A	26,290	6,573	2,506	-	35,369	-	-	-	3,750	3,750	39,119
33	59,059	10,738	5,314	-	75,111	-	-	-	8,450	8,450	83,561
34	47,454	8,628	4,270	-	60,352	-	-	-	4,050	4,050	64,402
35	31,720	6,978	2,951	-	41,649	-	-	-	4,870	4,870	46,519
35A	47,410	8,619	4,266	-	60,295	-	-	-	13,575	13,575	73,870
36	22,830	5,708	2,176	-	30,714	-	-	-	2,500	2,500	33,214
37	30,730	6,760	2,856	-	40,346	-	-	-	3,850	3,850	44,196
38	25,608	6,402	2,440	-	34,450	-	-	-	3,850	3,850	38,300
38A	75,812	11,372	6,648	-	93,832	-	-	-	18,825	18,825	112,657
39	119,760	15,568	10,319	-	145,647	-	-	-	20,025	20,025	165,672
48	29,084	7,271	2,772	-	39,127	-	-	-	4,805	4,805	43,932

(See footnotes on last page table 2.)

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION 1/ - Continued
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
(Dollars) 2/

Installation Period - July 1963-July 1971

Structure Site Number or Name	Installation Cost - Federal Funds					Installation Cost - Other Funds					Total Installation Cost
	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Federal	Construction	Installation Services: Engineering	Installation Services: Other	Land, Easements & R/W	Total Other	
Floodwater Retarding Structures - Continued											
50	64,735	9,710	5,677	-	80,122	-	-	-	20,225	20,225	100,347
51	34,562	7,604	3,215	-	45,381	-	-	-	5,745	5,745	51,126
52	48,279	8,778	4,344	-	61,401	-	-	-	6,550	6,550	67,951
53	40,700	7,400	3,662	-	51,762	-	-	-	5,510	5,510	57,272
54A	39,655	8,724	3,689	-	52,068	-	-	-	7,725	7,725	59,793
55	84,744	12,712	7,431	-	104,887	-	-	-	22,975	22,975	127,862
56	66,132	9,920	5,799	-	81,851	-	-	-	15,400	15,400	97,251
Subtotal	2,087,082	376,478	186,972	-	2,650,532	-	-	-	380,000	380,000	3,030,532
Multiple-Purpose Structure No. 41	114,300	13,290	10,220	21,203	159,013	33,310	2,950	2,270	32,772	71,302	230,315
Municipal Outlet Structure	-	-	-	-	-	13,560	1,490	1,150	-	16,200	16,200
Basic Recreational Facilities	8,320	950	830	4,300	14,400	8,320	950	830	4,945	15,045	29,445
Subtotal	122,620	14,240	11,050	25,503	173,413	55,190	5,390	4,250	37,717	102,547	275,960
Stream Channel Improvement											
Wilson Creek and Laterals	435,300	38,500	38,500	-	512,300	-	-	-	53,200	53,200	565,500
East Fork and Laterals	1,092,800	98,700	98,700	-	1,290,200	-	-	-	95,700	95,700	1,385,900
Subtotal	1,528,100	137,200	137,200	-	1,802,500	-	-	-	148,900	148,900	1,951,400
Total - Installation Period	3,737,802	527,918	335,222	25,503	4,626,445	55,190	5,390	4,250	566,617	631,447	5,257,892
GRAND TOTAL	4,924,350	736,632	443,954	25,503	6,130,439	55,190	5,390	4,250	773,732	838,562	6,969,001

1/ Does not include work plan preparation cost.

2/ Price Base: Actual contract cost for structures constructed prior to July 1963; 1962 prices for structures to be constructed during installation period.

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER								To Be Constructed During Installation Period
		1C	1DA	1E	3E 11/	6A	6B	8A	8B	17
Drainage Area	Sq.Mi.	2.39	1.55	5.90	0.49	1.96	3.43	3.71	3.28	1.34
Storage Capacity										
Sediment Pool	Ac.Ft.	163	154	198	22	125	200	195	200	87
Sediment Reserve Below Riser	Ac.Ft.	0	0	369	0	0	71	128	85	0
Water Supply	Ac.Ft.	-	-	-	-	-	-	-	-	-
Sediment in Detention Pool	Ac.Ft.	13	15	28	3	10	22	26	23	10
Floodwater Detention	Ac.Ft.	643	359	1,619	145	560	915	916	817	414
Total	Ac.Ft.	819	528	2,214	170	695	1,208	1,265	1,125	511
Surface Area										
Sediment Pool 3/	Acre	27	25	77	5	20	32	50	44	17
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	-
Floodwater Pool	Acre	80	51	188	25	59	93	116	104	55
Volume of Fill	Cu.Yd.	84,890	87,100	157,490	41,600	99,780	198,240	102,600	109,550	67,010
Elevation Top of Dam	Foot	705.6	695.3	709.8	597.4	602.1	602.1	683.2	709.5	612.6
Maximum Height of Dam 4/	Foot	45	42	47	28	55	56	42	44	43
Emergency Spillway										
Crest Elevation	Foot	701.5	691.3	705.5	594.5	597.5 10/	597.5 10/	679.0	705.0	609.1
Bottom Width	Foot	110	100	160	50	200	200	170	100	100
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 5/		3.8	5.5	3.9	3.7	4.0	4.0	4.0	3.9	3.9
Average Curve No. - Condition II		77	79	79	79	77	81	75	75	83
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour) 6/	Inch	6.54	6.65	6.24	6.87	6.60	6.46	6.39	6.43	6.66
Storm Runoff	Inch	3.95	4.26	3.90	4.47	4.00	4.30	3.61	3.65	4.71
Velocity of Flow (V_c) 7/	Ft./Sec.	0	0	0	0	0	0	0	0	0
Discharge Rate 7/	C.F.S.	0	0	0	0	0	0	0	0	0
Maximum Water Surface Elevation 7/	Foot	-	-	-	-	-	-	-	-	-
Freeboard Hydrograph										
Storm Rainfall (6-hour) 8/	Inch	15.30	15.71	14.60	16.06	14.92	14.92	15.07	15.03	15.60
Storm Runoff	Inch	12.22	12.91	11.83	13.26	11.85	12.43	11.69	11.66	13.38
Velocity of Flow (V_c) 7/	Ft./Sec.	8.5	8.8	9.0	7.2	9.3	9.3	8.7	8.6	7.9
Discharge Rate 7/	C.F.S.	2,220	2,120	3,585	582	5,082	5,082	3,590	2,490	1,572
Maximum Water Surface Elevation 7/	Foot	705.6	695.3	709.8	597.4	602.1	602.1	683.2	709.5	612.6
Principal Spillway Capacity (Maximum)	C.F.S.	30	20	74	8	25	43	46	41	17
Capacity Equivalents										
Sediment Volume	Inch	1.39	2.05	1.89	0.95	1.30	1.60	1.76	1.76	1.36
Water Supply Volume	Inch	-	-	-	-	-	-	-	-	-
Detention Volume	Inch	5.04	4.35	5.14	5.55	5.40	5.00	4.63	4.68	5.79
Spillway Storage 9/	Inch	2.97	3.10	3.02	3.10	2.95	2.72	2.76	2.80	3.00
Class of Structure		A	A	A	A	A	A	A	A	A

(See footnotes on last page table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued

East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER 18	19	20	21	22	23	26	To Be Constructed During Installation Period 26A	26B
Drainage Area	Sq.Mi.	2.59	1.53 1/	1.23	0.50	0.45	9.61 1/	3.81 1/	0.75	0.69
Storage Capacity										
Sediment Pool	Ac.Ft.	200	155	98	54	49	200	199	71	66
Sediment Reserve Below Riser	Ac.Ft.	17	0	0	0	0	548	51	0	0
Water Supply	Ac.Ft.	-	-	-	-	-	-	-	-	-
Sediment in Detention Pool	Ac.Ft.	7	12	8	4	4	98	20	9	7
Floodwater Detention	Ac.Ft.	422	438	340	139	123	2,490	1,048	209	191
Total	Ac.Ft.	646	605	446	197	176	3,336	1,318	289	264
Surface Area										
Sediment Pool 3/	Acre	33	28	14	7	8	94	28	12	12
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	-
Floodwater Pool	Acre	74	69	44	22	21	273	110	27	28
Volume of Fill	Cu.Yd.	90,190	49,800	55,880	37,390	60,460	115,320	96,220	37,850	36,110
Elevation Top of Dam	Foot	804.8	775.7	768.6	752.3	753.0	716.6	725.8	741.8	749.2
Maximum Height of Dam 4/	Foot	25	35	37	38	35	51	47	37	36
Emergency Spillway										
Crest Elevation	Foot	800.2	771.0	765.0	748.7	750.2	710.5	720.5	738.5	746.2
Bottom Width	Foot	150	200	64	50	54	200	150	90	90
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 5/		9.8	4.2	2.6	2.4	3.1	4.0	4.0	4.0	4.0
Average Curve No. - Condition II		83	82	71	69	73	80	79	79	79
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour) 6/	Inch	6.44	6.56	6.61	6.76	6.78	6.05	6.43	6.80	6.76
Storm Runoff	Inch	4.52	4.50	3.39	3.53	3.76	3.82	4.07	4.40	4.91
Velocity of Flow (V_c) 7/	Ft./Sec.	4.7	0	0	0	0	0	0	0	0
Discharge Rate 7/	C.F.S.	468	0	0	0	0	0	0	0	0
Maximum Water Surface Elevation 7/	Foot	801.4	-	-	-	-	-	-	-	-
Freeboard Hydrograph										
Storm Rainfall (6-hour) 8/	Inch	14.71	15.30	15.46	15.81	15.85	13.51	14.82	15.90	15.82
Storm Runoff	Inch	12.51	12.94	11.45	11.78	12.15	10.92	12.06	13.10	13.02
Velocity of Flow (V_c) 7/	Ft./Sec.	9.2	9.2	7.7	7.3	7.3	10.8	10.1	7.7	7.3
Discharge Rate 7/	C.F.S.	3,818	5,000	1,132	670	565	8,203	4,502	1,159	1,091
Maximum Water Surface Elevation 7/	Foot	804.8	775.7	768.6	752.3	753.0	716.6	725.8	741.8	749.2
Principal Spillway Capacity (Maximum)	C.F.S.	32	51	15	8	8	247	66	9	9
Capacity Equivalents										
Sediment Volume	Inch	1.62	2.05	1.62	2.16	2.24	1.65	1.33	2.00	2.00
Water Supply Volume	Inch	-	-	-	-	-	-	-	-	-
Detention Volume	Inch	3.06	5.35	5.20	5.24	5.16	4.86	5.16	5.23	5.21
Spillway Storage 9/	Inch	3.33	4.90	2.44	2.90	2.98	3.75	3.61	2.07	2.59
Class of Structure		A	A	A	A	A	A	A	A	A

(See footnotes on last page of table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued

East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER								To Be Constructed During Installation Period
		27	28 1/	29	29A 1/	30 1/	31	32	32A 1/	33 1/
Drainage Area	Sq.Mi.	1.16	0.78	1.30	0.50	0.93	0.97	1.27	0.53	1.28
Storage Capacity										
Sediment Pool	Ac.Ft.	123	68	92	42	109	103	117	48	141
Sediment Reserve Below Riser	Ac.Ft.	0	0	0	0	0	0	0	0	0
Water Supply	Ac.Ft.	-	-	-	-	-	-	-	-	-
Sediment in Detention Pool	Ac.Ft.	9	8	6	5	6	7	14	6	17
Floodwater Detention	Ac.Ft.	319	231	368	132	237	267	367	155	390
Total	Ac.Ft.	451	307	466	179	352	377	498	209	548
Surface Area										
Sediment Pool 3/	Acre	20	13	18	9	18	13	17	10	23
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	-
Floodwater Pool	Acre	44	41	48	21	40	32	42	22	52
Volume of Fill	Cu.Yd.	65,870	51,200	55,820	53,650	61,300	74,810	104,140	44,650	99,500
Elevation Top of Dam	Foot	714.5	719.6	697.4	655.9	667.0	662.7	655.1	642.3	656.5
Maximum Height of Dam 4/	Foot	46	29	30	27	34	37	34	33	35
Emergency Spillway										
Crest Elevation	Foot	710.8	716.6	694.1	652.5	664.3	659.3	651.0	639.0	653.0
Bottom Width	Foot	106	90	100	50	100	80	80	50	90
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 5/		4.0	4.0	3.4	3.4	3.8	3.2	4.0	3.4	4.0
Average Curve No. - Condition II		79	81	76	74	74	74	81	82	82
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour) 6/	Inch	6.67	6.75	6.70	6.87	6.84	6.75	6.66	6.80	6.67
Storm Runoff	Inch	4.29	4.57	3.99	3.94	3.95	3.84	4.50	4.70	4.61
Velocity of Flow (V_c) 7/	Ft./Sec.	0	0	0	0	0	0	0	0	0
Discharge Rate 7/	C.F.S.	0	0	0	0	0	0	0	0	0
Maximum Water Surface Elevation 7/	Foot	-	-	-	-	-	-	-	-	-
Freeboard Hydrograph										
Storm Rainfall (6-hour) 8/	Inch	15.61	15.80	15.65	16.01	15.78	15.78	15.57	16.02	15.61
Storm Runoff	Inch	12.82	13.29	12.41	12.55	12.20	12.24	13.06	13.65	13.61
Velocity of Flow (V_c) 7/	Ft./Sec.	7.8	7.3	7.8	7.8	6.2	8.0	8.5	7.8	8.3
Discharge Rate 7/	C.F.S.	1,568	1,030	1,583	678	1,030	1,298	1,660	722	1,639
Maximum Water Surface Elevation 7/	Foot	714.5	719.6	697.4	655.9	667.0	662.7	655.1	642.3	656.5
Principal Spillway Capacity (Maximum)	C.F.S.	14	10	16	8	12	12	16	8	16
Capacity Equivalents										
Sediment Volume	Inch	2.14	1.83	1.42	1.76	2.31	2.12	1.93	1.91	2.31
Water Supply Volume	Inch	-	-	-	-	-	-	-	-	-
Detention Volume	Inch	5.16	5.56	5.30	4.96	4.77	5.16	5.42	5.49	5.70
Spillway Storage 9/	Inch	2.59	3.33	2.48	2.93	2.28	2.25	2.85	3.05	3.24
Class of Structure		A	A	A	A	A	A	A	A	A

(See footnotes on last page of table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued

East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER 34	35 1/	35A	36 1/	37	38	38A	39	To Be Constructed During Installation Period 41
Drainage Area	Sq.Mi.	1.10	1.10	2.95	0.43	0.81	0.66	4.71 1/	6.25	4.24 1/
Storage Capacity										
Sediment Pool	Ac.Ft.	127	101	200	45	96	80	200	200	382
Sediment Reserve Below Riser	Ac.Ft.	0	0	71	0	0	0	242	404	-
Water Supply	Ac.Ft.	-	-	-	-	-	-	-	-	771 2/
Sediment in Detention Pool	Ac.Ft.	14	8	31	5	7	5	85	47	32
Floodwater Detention	Ac.Ft.	306	325	579	119	224	184	1,455	1,728	1,676
Total	Ac.Ft.	447	434	881	169	327	269	1,982	2,379	2,861
Surface Area										
Sediment Pool 3/	Acre	14	21	46	10	16	15	60	73	55
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	114
Floodwater Pool	Acre	35	48	116	22	34	39	167	160	218
Volume of Fill	Cu.Yd.	90,070	54,300	76,000	38,890	54,540	47,440	123,700	222,980	186,150
Elevation Top of Dam	Foot	631.3	739.6	780.9	738.3	712.3	799.4	729.5	735.8	687.2
Maximum Height of Dam 4/	Foot	45	32	33	30	33	30	47	49	54
Emergency Spillway										
Crest Elevation	Foot	628.0	736.5	777.0	735.7	709.2	796.3	725.5	729.2	680.5
Bottom Width	Foot	120	100	200	70	80	60	200	280	300
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 5/		4.5	4.0	6.4	4.5	4.6	4.8	4.0	4.5	2.0
Average Curve No. - Condition II		81	82	84	81	82	83	84	83	82
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour) 6/	Inch	7.10	6.64	6.45	6.82	6.76	6.68	6.82	9.34	9.58
Storm Runoff	Inch	4.54	4.58	4.63	4.63	4.69	4.72	5.08	7.26	7.38
Velocity of Flow (V_c) 7/	Ft./Sec.	0	0	2.8	0	0	0	0	5.6	0
Discharge Rate 7/	C.F.S.	0	0	140	0	0	0	0	1,600	0
Maximum Water Surface Elevation 7/	Foot	-	-	777.5	-	-	-	-	731.2	-
Freeboard Hydrograph										
Storm Rainfall (6-hour) 8/	Inch	16.60	15.53	15.09	15.97	15.86	15.79	14.68	20.92	20.29
Storm Runoff	Inch	13.21	13.14	13.03	13.46	13.60	13.60	12.63	18.62	17.90
Velocity of Flow (V_c) 7/	Ft./Sec.	7.8	7.6	8.5	7.4	7.4	7.4	8.7	11.0	11.4
Discharge Rate 7/	C.F.S.	1,789	1,296	3,786	642	1,101	750	4,063	11,700	13,850
Maximum Water Surface Elevation 7/	Foot	631.3	739.6	780.9	738.3	712.3	799.4	729.5	735.8	687.2
Principal Spillway Capacity (Maximum)	C.F.S.	14	14	74	8	10	8	67	78	131
Capacity Equivalents										
Sediment Volume	Inch	2.40	1.86	1.92	2.18	2.40	2.43	2.10	1.93	1.83
Water Supply Volume	Inch	-	-	-	-	-	-	-	-	3.41
Detention Volume	Inch	5.20	5.54	3.68	5.21	5.20	5.26	5.78	5.20	7.41
Spillway Storage 9/	Inch	2.60	2.80	3.63	2.61	2.45	4.28	3.02	4.02	7.58
Class of Structure		A	A	A	A	A	A	A	B	B

(See footnotes on last page of table 3.)

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TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued

East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	STRUCTURE NUMBER 48	50	51	52	53	54A	To Be Constructed During Installation Period 55	56	Total
Drainage Area	Sq.Mi.	0.92	5.87	1.09	1.38	1.15	1.68	4.96	2.28	95.51
Storage Capacity										
Sediment Pool	Ac.Ft.	78	200	64	116	91	94	200	195	5,748
Sediment Reserve Below Riser	Ac.Ft.	0	126	0	0	0	0	205	0	2,317
Water Supply	Ac.Ft.	-	-	-	-	-	-	-	-	771 2/
Sediment in Detention Pool	Ac.Ft.	7	25	6	9	7	11	32	18	746
Floodwater Detention	Ac.Ft.	244	1,778	303	384	321	506	1,410	900	26,696
Total	Ac.Ft.	329	2,129	373	509	419	611	1,847	1,113	36,278
Surface Area										
Sediment Pool 3/	Acre	12	52	15	15	13	29	78	35	1,178
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	114
Floodwater Pool	Acre	31	170	42	45	36	70	237	125	3,376
Volume of Fill	Cu.Yd.	54,360	111,660	50,000	76,950	58,600	67,310	161,990	117,380	3,730,740
Elevation Top of Dam	Foot	605.9	620.3	609.1	628.0	602.1	593.5	583.0	570.0	xxx
Maximum Height of Dam 4/	Foot	38	50	34	46	46	29	35	37	xxx
Emergency Spillway										
Crest Elevation	Foot	602.0	615.7	605.3	624.5	598.5	590.0	579.0	565.0	xxx
Bottom Width	Foot	60	190	80	100	80	100	140	110	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Percent Chance of Use 5/		3.9	4.0	4.0	3.7	4.0	4.0	4.0	2.0	xxx
Average Curve No. - Condition II		76	84	79	77	79	82	83	83	xxx
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour) 6/	Inch	6.70	6.24	6.73	6.70	6.72	6.62	6.35	9.77	xxx
Storm Runoff	Inch	3.99	4.43	4.91	4.09	4.33	4.56	4.42	7.68	xxx
Velocity of Flow (V_c) 7/	Ft./Sec.	0	0	0	0	0	0	0	2.5	xxx
Discharge Rate 7/	C.F.S.	0	0	0	0	0	0	0	60	xxx
Maximum Water Surface Elevation 7/	Foot	-	-	-	-	-	-	-	565.5	xxx
Freeboard Hydrograph										
Storm Rainfall (6-hour) 8/	Inch	15.68	14.72	15.89	15.67	15.91	15.48	14.85	22.10	xxx
Storm Runoff	Inch	12.44	12.67	13.82	12.58	12.91	13.12	12.65	19.80	xxx
Velocity of Flow (V_c) 7/	Ft./Sec.	8.5	9.2	8.4	8.0	8.2	8.0	8.6	10.0	xxx
Discharge Rate 7/	C.F.S.	1,148	4,675	1,500	1,625	1,360	1,588	2,820	3,339	xxx
Maximum Water Surface Elevation 7/	Foot	605.9	620.3	609.1	628.0	602.1	593.5	583.0	570.0	xxx
Principal Spillway Capacity (Maximum)	C.F.S.	12	73	14	17	14	21	124	40	xxx
Capacity Equivalents										
Sediment Volume	Inch	1.73	1.12	1.20	1.71	1.60	1.17	1.65	1.75	xxx
Water Supply Volume	Inch	-	-	-	-	-	-	-	-	xxx
Detention Volume	Inch	4.98	5.68	5.20	5.22	5.23	5.65	5.33	7.40	xxx
Spillway Storage 9/	Inch	2.90	3.00	3.35	2.37	2.27	3.13	4.20	5.95	xxx
Class of Structure		A	A	A	A	A	A	A	B	xxx

(See footnotes on last page of table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURE - Continued
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Item	Unit	Total for 31 Structures Constructed Prior to July 1963	Total for 44 Structures to be Constructed in Installation Period	Project Total
Drainage Area	Sq.Mi.	64.32	95.51	159.83
Storage Capacity				
Sediment Pool	Ac.Ft.	4,852	5,748	10,600
Sediment Reserve Below Riser	Ac.Ft.	1,207	2,317	3,524
Water Supply	Ac.Ft.	-	771	771
Sediment in Detention Pool	Ac.Ft.	286	746	1,032
Floodwater Detention	Ac.Ft.	17,223	26,696	43,919
Total	Ac.Ft.	23,568	36,278	59,846
Surface Area				
Sediment Pool 3/	Acre	719	1,178	1,897
Water Supply Pool	Acre	-	114	114
Floodwater Pool	Acre	2,072	3,376	5,448
Volume of Fill	Cu.Yd.	3,038,147	3,730,740	6,768,887
Elevation Top of Dam	Foot	xxx	xxx	xxx
Maximum Height of Dam	Foot	xxx	xxx	xxx
Emergency Spillway				
Crest Elevation	Foot	xxx	xxx	xxx
Bottom Width	Foot	xxx	xxx	xxx
Type		xxx	xxx	xxx
Percent Chance of Use		xxx	xxx	xxx
Average Curve No. - Condition II		xxx	xxx	xxx
Emergency Spillway Hydrograph				
Storm Rainfall (6-hour)	Inch	xxx	xxx	xxx
Storm Runoff	Inch	xxx	xxx	xxx
Velocity of Flow (V_c)	Ft./Sec.	xxx	xxx	xxx
Discharge Rate	C.F.S.	xxx	xxx	xxx
Maximum Water Surface Elevation	Foot	xxx	xxx	xxx
Freeboard Hydrograph				
Storm Rainfall (6-hour)	Inch	xxx	xxx	xxx
Storn Runoff	Inch	xxx	xxx	xxx
Velocity of Flow (V_c)	Ft./Sec.	xxx	xxx	xxx
Discharge Rate	C.F.S.	xxx	xxx	xxx
Maximum Water Surface Elevation	Foot	xxx	xxx	xxx
Principal Spillway Capacity (Maximum)	C.F.S.	xxx	xxx	xxx
Capacity Equivalents				
Sediment Volume	Inch	xxx	xxx	xxx
Water Supply Volume	Inch	xxx	xxx	xxx
Detention Volume	Inch	xxx	xxx	xxx
Spillway Storage	Inch	xxx	xxx	xxx
Class of Structure		xxx	xxx	xxx

Footnotes - To Be Constructed During Installation Period

1/ Exclusive of area controlled by other floodwater retarding structures.

2/ Consists of 251 acre-feet of recreational water storage and 520 acre-feet of municipal water supply storage.

3/ Area at top of riser, exclusive of sediment pool area of multiple-purpose Site No. 41

4/ Measured from centerline of stream channel to effective top of dam.

5/ Based on regional analysis of gaged runoff. All structures exceed minimum requirements in Washington Engineering Memorandum SCS-27.

6/ .5P for Class (A) structures and .75P for Class (B) structures. Value of P taken from Figure 3.21-1, Supplement A, Section 4, National Engineering Handbook.

7/ Maximum during passage of hydrograph.

8/ 1.17P for Class (A) structures and 1.70P for Class (B) structures. Value of P taken from Figure 3.21-1, Supplement A, Section 4, National Engineering Handbook, as modified by Engineering and Watershed Planning Unit Technical Letter Code EWP-H-3, dated June 8, 1959.

9/ Storage from emergency spillway crest to top of dam.

10/ Sites 6A and 6B have a common spillway and the two sites will function as a single reservoir.

11/ Corrugated metal pipe used for principal spillway.

TABLE 3A - STRUCTURE DATA - STREAM CHANNEL IMPROVEMENT
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Channel Designation	Station Numbering for Reach Station	Station	Watershed Area 1/	Required Channel Capacity	Planned Channel Capacity	Average Bottom Width	Average Side Slope	Average Depth	Average Grade	Average Velocity in Channel	Volume of Excavation
	(100 ft.)	(100 ft.)	(sq.mi.)	(c.f.s.)	(c.f.s.)	(ft.)		(ft.)	(pct.)	(ft./sec.)	(1000 cu. yds.)
East Fork											
13E	0+00	34+00	37.16	3,560	3,560	60	2:1	9.4	0.120	4.81	
12E	34+00	58+00	38.67	3,695	3,695	60	2:1	9.6	0.120	4.86	
11E	58+00	189+00	38.68	3,760	3,770	60	2:1	10.1	0.100	4.60	
10AE	189+00	226+00	41.18	4,250	4,250	66	2:1	10.4	0.100	4.70	
10E	226+00	293+00	42.39	4,225	4,275	70	2:1	10.4	0.100	4.74	
9E	293+00	401+00	43.94	4,615	4,695	70	2:1	11.0	0.090	4.64	
8E	401+00	471+00	42.84	5,535	5,535	80	2:1	11.3	0.090	4.78	
7E	471+00	567+00	42.96	5,860	5,900	80	2:1	11.9	0.085	4.78	
6E	567+00	692+00	44.29	6,105	6,100	80	2:1	12.1	0.085	4.83	
5E	692+00	840+00	46.18	6,505	6,560	80	2:1	13.1	0.075	4.72	
4E	840+00	1054+00	47.62	6,715	6,720	80	2:1	13.5	0.070	4.65	
										Subtotal	3,775.3
East Fork Tributaries											
Dr-1A	0+00	28+00	0.39	500	500	-	2:1	-	-	5.00	14.0 2/
Dr-2A	0+00	25+00	0.38	500	500	-	2:1	-	-	5.00	12.5 2/
Dr-4	0+00	18+00	5.68	1,330	1,330	50	2:1	4.6	0.30	5.00	25.0
Dr-5	0+00	7+00	1.20	870	870	40	2:1	3.7	0.40	5.00	6.7
Dr-7	0+00	6+00	0.42	520	520	26	2:1	3.3	0.50	5.00	4.6
Dr-7A	0+00	22+00	0.36	480	520	-	2:1	-	-	5.00	11.0 2/
Dr-8	0+00	10+00	0.69	740	740	44	2:1	3.0	0.50	5.00	7.5
Dr-9	0+00	5+00	0.38	500	500	24	2:1	3.3	0.50	5.00	3.3
Dr-11	0+00	11+00	1.20	870	870	30	2:1	4.5	0.35	5.00	10.0
Dr-12	0+00	15+00	4.37	1,070	1,070	16	2:1	7.0	0.25	5.00	18.0
Dr-14	0+00	12+00	0.40	510	510	10	2:1	5.0	0.40	5.00	9.1
Dr-15	0+00	7+00	0.80	720	720	12	2:1	5.5	0.35	5.00	4.0
Dr-16	0+00	13+00	0.22	370	370	10	2:1	4.1	0.50	5.00	5.6
Dr-17	0+00	8+00	0.48	560	560	16	2:1	4.5	0.40	5.00	4.3
Dr-18	0+00	9+00	1.70	1,040	1,040	18	2:1	6.8	0.25	5.00	10.0
	9+00	15+00	0.80	720	720	20	2:1	4.9	0.35	5.00	3.4
Dr-20	0+00	10+00	0.90	760	760	8	2:1	7.0	0.30	5.00	7.3
Dr-21	0+00	16+00	2.54	1,280	1,280	30	2:1	6.0	0.25	5.00	20.0
Dr-22	0+00	9+00	0.90	760	760	32	2:1	3.8	0.40	5.00	9.1
Dr-23	0+00	9+00	1.40	940	-	-	2:1	-	-	5.00	8.2 2/
Dr-24	0+00	12+00	1.20	870	-	-	2:1	-	-	5.00	10.5 2/
										Subtotal	204.1

TABLE 3A - STRUCTURE DATA - STREAM CHANNEL IMPROVEMENT - Continued
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Channel Designation	Station Numbering for Reach Station (100 ft.)	Station (100 ft.)	Watershed Area 1/ (sq.mi.)	Required Channel Capacity (c.f.s.)	Planned Channel Capacity (c.f.s.)	Average Bottom Width (ft.)	Average Side Slope	Average Depth (ft.)	Average Grade (pct.)	Average Velocity in Channel (ft./sec.)	Volume of Excavation (1000 cu. yds.)
Wilson Creek											
1W	0+00	99+00	41.09	4,056	4,120	90	2:1	8.1	0.13	4.79	
2W	99+00	164+00	38.19	3,860	3,870	90	2:1	7.8	0.13	4.70	
3W	164+00	260+00	32.48	3,522	3,550	90	2:1	7.4	0.13	4.58	
4W	260+00	312+00	30.88	3,400	3,440	88	2:1	7.0	0.15	4.76	
5W	312+00	356+00	29.28	3,276	3,320	86	2:1	7.0	0.15	4.75	
6W	356+00	422+00	26.88	3,084	3,100	80	2:1	7.0	0.15	4.72	
6AW	422+00	442+00	22.69	2,768	2,768	72	2:1	7.0	0.15	4.67	
6BW	442+00	518+00	20.19	2,546	2,520	64	2:1	7.0	0.15	4.62	
										Subtotal	1,397.0
Wilson Creek Tributaries											2/
Dr-25	0+00	7+00	1.20	870	870	-	2:1	-	-	5.00	5.0
Dr-26	0+00	6+00	0.66	700	700	-	2:1	-	-	5.00	3.0
Dr-27	0+00	15+00	3.65	1,520	1,520	-	2:1	-	-	5.00	9.0
Dr-28	0+00	4+00	0.40	510	510	-	2:1	-	-	5.00	2.0
Dr-29	0+00	12+00	0.20	360	360	-	2:1	-	-	5.00	6.0
Dr-30	0+00	5+00	0.28	430	430	-	2:1	-	-	5.00	2.5
Dr-31	0+00	9+00	0.33	460	460	-	2:1	-	-	5.00	4.5
Dr-32	0+00	5+00	0.70	670	670	-	2:1	-	-	5.00	3.5
Dr-33	0+00	10+00	0.37	490	490	-	2:1	-	-	5.00	5.0
Dr-34	0+00	10+00	0.40	510	510	-	2:1	-	-	5.00	5.0
Dr-35	0+00	10+00	0.50	570	570	-	2:1	-	-	5.00	5.5
Dr-36	0+00	10+00	0.70	670	670	-	2:1	-	-	5.00	6.0
Dr-37	0+00	15+00	0.80	720	720	-	2:1	-	-	5.00	10.0
Dr-38	0+00	12+00	1.70	1,040	1,040	-	2:1	-	-	5.00	10.0
										Subtotal	77.0
										GRAND TOTAL	5,453.4

1/ Does not include the area controlled by floodwater retarding structures.

2/ Estimated from data developed for East Fork and Wilson Creek.

TABLE 4 - ANNUAL COST
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Wilson Creek			
Floodwater Retarding Structures 1A, 1B, 1C, 1DA, 1E, 2A, 2B, 3A, 3B, 3C, 3D, 3E, 4, 5A, 6A, and 6B and 12.27 Miles of Stream Channel Improvement	62,956	4,000	66,956
East Fork			
Floodwater Retarding Structures 8A through 8H, 9 through 24, 26, 26A, 26B, 27, 28, 29, 29A, 30, 31, 32, 32A, 33, 34, 35, 35A, 36, 37, 38, 38A, 39, 42 through 48, 50 through 53, and 54A; Multiple-Purpose Structure No. 41, including Basic Recreational Facilities; and 25.02 Miles of Stream Channel Improvement	199,229	14,400 3/	213,629
Ticky Creek			
Floodwater Retarding Structures 55 and 56	8,750	200	8,950
TOTAL	270,935	18,600	289,535

1/ Installation costs on structures to be installed based on 1962 prices amortized for 50 years at 3.0 percent. Actual cost used for structures already installed.
2/ Long-term prices as projected by ARS, September 1957.
3/ Includes $3,500 for operation and maintenance for basic recreational facilities.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	230,754	51,317	179,437
Other Agricultural	67,672	9,084	58,588
Nonagricultural (Road and Bridge)	50,179	6,646	43,533
Subtotal	348,605	67,047	281,558
Sediment			
Overbank Deposition	18,051	1,680	16,371
Lavon Reservoir	15,500	8,577	6,923
Subtotal	33,551	10,257	23,294
Erosion			
Flood Plain Scour	9,361	913	8,448
Indirect	39,152	7,822	31,330
TOTAL	430,669	86,039	344,630

1/ Price Base: Long-term as projected by ARS, September 1957.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/						Average Annual Cost 2/	Benefit-Cost Ratio
	Damage Reduction	More Intensive and Changed Land Use	Recreation 4/	Municipal Water	Secondary	Total		
Wilson Creek								
Floodwater Retarding Structures 1A, 1B. 1C, 1DA, 1E, 2A, 2B, 3A, 3B, 3C, 3D, 3E, 4, 5A, 6A, 6B, and 12.27 Miles of Stream Channel Improvement	79,222	33,999	800	-	12,721	126,742	66,956	1.9:1
East Fork								
Floodwater Retarding Structures 8A through 8H, 9 through 24, 26, 26A, 26B, 27, 28, 29, 29A, 30, 31, 32, 32A, 33, 34, 35, 35A, 36, 37, 38, 38A, 39, 42 through 48, 50 through 53, and 54A; Multiple-Purpose Structure No. 41, including Basic Recreational Facilities, and 25.02 Miles of Stream Channel Improvement	238,275	51,804	17,850	9,059	31,199	348,187	213,629	1.6:1
Ticky Creek								
Floodwater Retarding Structures 55 and 56	12,053	2,629	100	-	1,475	16,257	8,950	1.8:1
GRAND TOTAL 3/	329,550	88,432	18,750	9,059	45,395	491,186	289,535	1.7:1

1/ Price Base: Long-term as projected by ARS, September 1957.
2/ From table 4.
3/ In addition, it is estimated that land treatment measures will provide annual flood damage reduction benefits of $15,080.
4/ Of the amount shown, $3,750 is attributed to incidental recreation benefits.

TABLE 7 - CONSTRUCTION UNITS
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)
(Dollars)

Unit No.	Measures in Construction Unit	Annual Benefit	Annual Cost
	Wilson Creek		
1a	Structure 1E	9,542	4,846
1b	Structures 1A, 1B, 1C, and 1DA	11,751	9,801
1c	Structures 2A, 2B, 3A, 3B, 3C, 3D, 3E, 4, and 5A	31,596	19,450
1d	Structures 6A and 6B	8,771	8,459
1e	Units 1a, 1b, 1c, and 1d plus 12.27 Miles of Stream Channel Improvement	114,021	66,956
	Honey Creek		
2	Structures 8A, 8B, 8C, 8D, 8E, 8F, 8G, 8H, and 9 through 17	64,208	42,232
	Upper East Fork		
3a	Structures 18 through 22	13,288	10,776
3b	Unit 3a plus Structure 23	33,278	15,937
3c	Structures 26, 26A, 26B, and 27	13,466	8,660
3d	Structures 35, 35A, 36, and 37	11,151	8,088
3e	Units 3b, 3c, and 3d plus Structures 28, 29, 29A, 30, and 31	67,417	42,698
	Whites Creek		
4a	Structures 38, 29, and 41	45,329	22,656
4b	Unit 4a plus Structure 38A	54,314	27,135
	Hurricane Creek		
5	Structures 42 through 45	18,098	9,193
6	Throckmorton Creek Structures 46 and 47	9,133	5,725
	East Fork Above Its Confluence With Honey Creek		
7	Units 3e, 4b, 5, and 6 plus Structures 32, 32A, 33, 34, and 48	158,834	97,335
	Laterals to East Fork Below Confluence With Honey Creek		
8	Structures 50 through 53 and 24 1/	13,073	12,738
	Big Branch		
9	Structure 54A	2,876	2,424
	East Fork		
10	Units 2 and 7 plus 25.02 Miles of Stream Channel Improvement	301,039	198,467
	Ticky Creek		
11	Structures 55 and 56	14,782	8,950

1/ May be considered for construction after a sufficient number of structures have been constructed which provides an appreciable degree of control.

INVESTIGATIONS AND ANALYSES

Surveys and investigations made for the development of the Watershed Work Plan (August 1956) were considered and used where adequate. These data were supplemented where necessary in preparing this supplemental work plan.

Land Use and Treatment Investigations

At a meeting held in McKinney the measures for land treatment required to establish a sound soil, water, and plant conservation program for the watershed were determined.

The status of land treatment measures for the watershed was developed by the soil conservation districts with assistance from Soil Conservation Service work unit personnel from Van Alstyne and McKinney.

Conservation needs data and conservation plans previously developed were examined. Studies of recent soil surveys representing a 5.5 percent sample (12,390 acres) of the watershed, when expanded, indicated the required kinds and amounts of measures and practices by land capability units. The kinds and amounts of land treatment practices to be applied on farms under conservation plans were obtained from records maintained by the Soil Conservation Service and expanded to represent the watershed area.

Trends in farming operations, expected changes in land use, soil condition, land tenure, and other pertinent data were used. From these data, land treatment measures expected to be applied during the 8-year installation period were selected. Past rates of application were examined, and the need for funds to be used for accelerated technical assistance was determined.

Land treatment practices that have been applied on farms under conservation plans obtained from accomplishment records maintained by the Soil Conservation Service, were expanded to represent those applied to date within the watershed.

An estimate was made of the measures that could be applied in the 8-year installation period. The acres to be treated and cost of treatment measures are shown in table 1.

Table 1A reflects the cost of land treatment measures applied prior to development of the supplemental work plan.

Engineering Investigations

The following steps were taken in making the engineering investigations:

1. A map of the watershed prepared in connection with the

1956 work plan showing the watershed boundary, drainage pattern, system of roads, and other pertinent information was used. A stereoscopic study of consecutive 4-inch aerial photographs was used to locate possible floodwater retarding structure sites. Locations of the structure sites and valley cross sections were shown on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations (figure 7).

2. A field examination was made of all possible floodwater retarding structure sites located stereoscopically. Sites which did not show good storage possibilities or in which obstacles were encountered, making the site unfeasible from an economic standpoint, were dropped from further consideration.

   A system of floodwater retarding structures was selected from the remaining sites for further consideration and detailed survey. Plans of a floodwater retarding structure typical of those planned for the watershed are illustrated by figures 2 and 2A.

3. Topographic maps with 4-foot contour intervals and a scale of 1 inch = 660 feet were developed on aerial photographs from engineering surveys of the pool, dam, and emergency spillway areas of each site. The height of the dams and the size of the pools were determined by the storage volume needed to detain the runoff from the principal spillway design storm and to provide storage needed for sediment in the single-purpose floodwater retarding structures, plus additional storage for water supply in site 41.

   Additional cross sections and profile data were obtained to supplement valley section data to make designs and cost estimates for stream channel improvement.

4. Structure data tables were developed to show for each floodwater retarding structure and the multiple-purpose structure the drainage area, storage capacity planned for floodwater detention, sediment, and water supply storage, release rate of the principal spillway, emergency spillway capacity, area inundated by the pools, volume of fill in the dam, estimated cost, and other pertinent data (tables 2 and 3).

   Tables were developed for stream channel improvement to show watershed area, planned capacity, design data,

volume of excavation, estimated cost, and other pertinent data (tables 2 and 3A).

5. In accordance with criteria set forth in Washington Engineering Memorandum SCS-27, the minimum floodwater detention volume is the expected runoff from a 6-hour, 25-year rainfall for class (a) structures and a 6-hour, 50-year rainfall for class (b) structures. The 6-hour rainfall amounts were selected from U. S. Weather Bureau Technical Paper No. 40.

   Additional capacity was planned in 20 class (a) sites to detain the expected runoff from a 25-year storm event and in 2 class (b) sites to detain the expected runoff from a 50-year storm event as determined from a regional analysis of stream gage records. Site 35A has site limitations which precludes detaining the additional volume. Detention volumes in all sites meet or exceed the minimum set forth in Washington Engineering Memorandum SCS-27.

   The percent chance of use of the emergency spillway as shown in table 3 is based on a regional analysis of gaged runoff.

6. Appropriate spillway design and freeboard storms were selected from figures 3.21-1 and 3.21-4, National Engineering Handbook, Section 4, Supplement A, in accordance with criteria contained in Engineering Memorandum SCS-27 and modified by Engineering and Watershed Planning Unit Technical Letter EWP-H-3.

   Spillway design and freeboard inflow hydrographs were developed for each of the floodwater retarding structures and the multiple-purpose structure by the distribution graph method. Various combinations of spillway widths and depths were computed in order to determine the most economical structure. All floodwater retarding structures and the multiple-purpose structure were graphically flood routed using the Goodrich flood routing method described on page 5.8-12 of the National Engineering Handbook, Section 5, to determine the effective top of dam.

7. Estimates were made of the volume of fill in the dams and the costs of the structures. Total costs were determined from a preliminary design and cost estimate of significant individual items such as embankment, principal spillway, clearing, and fencing. Unit prices were

determined from recent contracts of structures in similar sites. Conditions peculiar to an individual site such as wet excavation and clearing of dense timber were considered. Estimate of the volume of excavation for stream channel improvement was made using the additional cross sections surveyed. Where feasible, the natural channel was used and considered in the estimate of excavation. Amount of clearing was estimated from recent aerial photographs. Unit prices were determined from recent contracts.

Cost distribution tables were developed (table 2).

Hydraulic and Hydrologic Investigations

The following steps were taken as part of the hydrologic and hydraulic investigations:

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau, U. S. Geological Survey Water Supply Papers, and local records. These data were analyzed to determine average precipitation depth-duration relationships, seasonal distribution of precipitation, frequency of occurrence of meteorological events, historical flood series, rainfall-runoff-peak discharge relationships, and the relationship of geology, soils and climate to runoff depth for single storm events.

2. Engineering surveys were made of channel and valley cross sections, high water marks, bridges, and improved channels, and for planning stream channel improvement. The cross sections were located to represent adequately the stream hydraulics and flood plain area. Evaluation reaches were delineated in conference with the economist and geologist.

   Valley cross sections were surveyed originally in 1949 and 1950. The Work Plan of August 1956 used only a selected number of these sections. The supplemental work plan required additional valley cross sections 4EP through 8EP on East Prong downstream from Site No. 35A and BB1 through BB4 downstream from Site No. 54A.

   Partial valley cross sections for planning stream channel improvement were surveyed at approximately 1,000-foot intervals on the main stem of East Fork and on Wilson Creek in the reaches where channel improvement was studied and planned.

3. The before-project hydrologic conditions of the watershed were determined on the basis of cover conditions, land treatment, soil groups, and crop distribution. The II-Curve number for the hydrologic soil-cover complex was determined from a 24 percent sample of the watershed.

   The after-project conditions were determined by analyzing the results of the land treatment that would be applied during the installation period.

4. Cross section rating curves were computed from field survey data by the use of Manning's formula.

5. Gaged data on similar watersheds were used to determine a peak discharge of 7,500 c.f.s. per inch of runoff for a watershed of 345 square miles. These data also indicated the value of "n" to be 0.5 in the equation $q_1 = q_2 \ (A_1 \div A_2)^n$ where subscript 1 indicates the smaller drainage area and subscript 2 indicates the total drainage area.

6. Stage-area inundated curves were developed from field survey data for each portion of the valley represented by a cross section. Composite runoff-area inundated curves were developed for each evaluation reach by routing selected volumes of runoff through the reach by the concordant flow procedures. Similar families of curves were developed to show the effect of the system of floodwater retarding structures and the additional benefits of an improved channel in selected reaches.

7. From a tabulation of cumulative departure from normal precipitation at the time of original planning, the period 1923 through 1942 was determined to be representative of normal precipitation on the watershed. The historical evaluation series for this supplemental work plan was developed from that period, with individual events limited to a period of 2 days. The McKinney gage was used when its records were adequate during the period 1923 through 1936. Most of the gaps in these records were filled by weighted precipitation data from the Carrollton, Greenville, and Sherman gages. The remaining gaps in the McKinney records and the period 1937 through 1942 were supplied by weighted values from the Bonham, Greenville, and Sherman gages. Weighting was done by the Thiessen polygon method.

8. Determinations were made of the area that would have been inundated by each storm of the evaluation series under each of the following conditions:

   a. Without project; this condition uses the before-project soil-cover complex number and assumes no treatment measures in place.

   b. The installation of land treatment measures for watershed protection.

   c. The installation of land treatment measures and floodwater retarding structures.

   d. The installation of land treatment measures, floodwater retarding structures, and improved stream channels.

9. The evaluation series contained 84 storms that would cause flood damage at the smallest cross section, or an average of approximately four floods per year.

10. The runoff from the largest storm in the historical evaluation flood series was routed to determine the maximum flood plain area that would be used in the computations of damages and benefits.

11. The improved stream channels were determined by computing the costs and benefits of two channel sizes which provide different levels of protection. The selected design was planned to protect the flood plain from damage by a storm which would produce a 2-inch depth of runoff from the watershed. The average cross section of the improved channel will carry the runoff from 69 of the 84 storms without causing damage.

12. Reservoir operation studies were made on the multiple-purpose reservoir considering the following:

   a. Storage data tables developed and plotted as shown in figure 4.

   b. The most critical drought period of record (calendar years 1951 through February 1957).

   c. Gaged streamflow records for Honey Creek, a nearby tributary of East Fork (Above Lavon) main stem.

   d. Monthly rainfall records maintained at McKinney, Texas.

e. Gross lake surface evaporation was based on Texas Water Commission data (Texas Board of Water Engineers' Bulletin 6006), with adjustment for pan coefficient to conform with data in U. S. Department of Commerce, Weather Bureau, Technical Paper No. 37.

f. Based on historical uses of water supply (1950-1963) furnished by Texas Water Commission, monthly future water requirements, allowing 75 percent average annual increase based on 1962 use, for the city of Van Alstyne, Texas, were developed as shown in the following tabulation:

Monthly Water Demands
Van Alstyne, Texas

Month	Gallons	Acre-Feet
January	7,700,000	23
February	7,300,000	22
March	8,000,000	24
April	8,000,000	24
May	8,300,000	25
June	9,300,000	28
July	13,000,000	39
August	13,000,000	39
September	10,700,000	32
October	9,700,000	29
November	8,700,000	26
December	8,700,000	26

The operation studies, considering evaporation from the sediment pool of the site in series upstream, were made through the selected period assuming recreation independently and both purposes combined to determine the following:

a. Minimum storage and surface area reached due to loss by evaporation from the recreation pool.

b. Minimum storage reached by the multiple-purpose pool due to loss by evaporation and use by the city of Van Alstyne.

The results of these operations were plotted and are shown as figure 5.

At the low point of supply during the drought period used in the study, water in storage for the combined purposes would exceed the 50-year sediment storage by approximately 30 acre-feet.

Sedimentation Investigations

Sedimentation investigations for the work plan were made in accordance with procedures as outlined in Technical Release No. 17, "Geologic Investigations for Watershed Planning," March 1961, and Technical Release No. 12, "Procedures for Computing Sediment Requirements for Retarding Reservoirs, September 1959, U. S. Department of Agriculture, Soil Conservation Service.

Sediment Source Studies

Thirty-one structures have been constructed, and 21 structures are in the design or construction stage. Sediment source studies to determine the 50-year sediment storage requirements were made in the drainage areas of the 23 remaining structure sites according to the following procedures:

1. Field surveys to determine gross sheet erosion included: mapping soil units by slope in percent, slope length in feet, present land use, present land treatment on cropland, present cover condition on pasture and woodland, and land capability classes. Gully and streambank channel investigations included mapping lengths, depths, and estimated annual lateral erosion of stream channels and gullies, and the estimated annual headward erosion of gullies.

2. Computations included summarizing erosion by sources (sheet, gully, and streambank erosion), and the use of appropriate formulas to compute the annual gross erosion in tons.

3. The gross erosion rates were then adjusted to reflect the effect of land treatment above the planned structures. The computed sediment storage requirement for each structure is based on a gradual improvement of watershed conditions as a result of the expected application of needed land treatment measures during the installation period and maintaining these measures at 75 percent effectiveness for the remainder of the project period.

4. Sediment storage requirements for structures were determined by adjusting annual gross erosion for expected delivery ratios and trap efficiency.

5. The ratio of sediment storage volume in the pools to soils in place was based on volume weights ranging from 75 to 82 pounds per cubic foot (soil in place) and 52 to 57 pounds per cubic foot (sediment).

6. The allocation of sediment to structure pools ranged from 10 to 15 percent deposition in the detention pool and 85 to 90 percent in the sediment pool.

Flood Plain Sedimentation and Scour Damages

The following sedimentation and scour damage investigations were made to determine the nature and extent of physical damage to the flood plain:

1. Hand auger borings were made along each of the valley cross sections (figure 7), making note of the depth and texture of the deposit, soil conditions, scour channels, stream channel aggradation or degradation, and other pertinent factors contributing to flood plain damage.

2. Estimates of past physical flood plain damage were obtained through interviews with landowners and operators and by comparing crops on damaged and undamaged land.

3. A damage table was developed to show percent of damage by texture and depth increments for deposition and percent of damage by depth and width for scour channels.

4. The depth and area of damaging sediment deposits and scour channels were measured and tabulated.

5. The damage to the productive capacity of the flood plain was assessed by percent for each type damage.

6. The sedimentation and scour damages were summarized by evaluation reaches for the entire flood plain. Estimates of recoverability of productive capability were developed as a result of field studies and interviews with farmers.

7. Using the average annual erosion rates as a basis, the average annual sediment yields to selected reaches of the flood plain were estimated for present conditions, with land treatment, and with structural measures installed. The results were compared to show the average annual reduction of overbank deposition. The reduction of scour damage is based on reductions in depth and area inundated.

Sedimentation in Lavon Reservoir

The estimate of the present sediment yield to Lavon Reservoir is based on (1) a reservoir sedimentation resurvey of Lavon Reservoir in 1959 by the U. S. Corps of Engineers, and (2) a detailed study of sediment sources and the use of delivery ratio curves developed by the Soil Conservation

Service. The estimated present sediment yield to Lavon Reservoir from East Fork Above Lavon watershed is 1.8 acre-feet per square mile. The estimated annual contribution from the watershed with the watershed project installed and functioning will be 1.0 acre-foot per square mile.

Channel Stability Investigations

The alinement of the sections of channel to be improved on the main stem and Wilson Creek generally follows the existing channels. Design depths of these channels are approximately the same as present depths. Field investigations of the existing channels and seismic tests made in unexposed sections revealed localized areas of Austin limestone in the lower reaches. This rock lies 1 to 2 feet above the proposed channel grade and the volume to be excavated will be minor.

The existing channels appear stable with the exception of some lateral erosion in meander bends. Materials are cohesive and are classified as CL. Mechanical analysis and plasticity index values determined on similar calcareous, alluvial clays in the watershed were used in a tractive force study. The results indicate that the channel will be stable under design velocities.

Geologic Investigations

Preliminary geologic investigations were made at each of the remaining 23 structure sites to obtain information on the type and extent of embankment materials, foundation materials, and spillway excavation that will be encountered in construction. Surface examinations included observations of valley slopes, alluvium, channel banks, and exposures of geologic formations. Equipment used in subsurface exploration included a portable power auger, hand auger, and seismograph. More detailed investigations were conducted on Sites 23 and 41 (multiple-purpose structure) with core drilling equipment. No problems are anticipated in connection with the ability of the multiple-purpose site to hold water. Reports of detailed investigations and construction experience in the watershed provided for a more accurate evaluation of the remaining sites.

Description of Problems

Upper Cretaceous formations of the Eagle Ford, Austin, and Taylor groups crop out in the watershed. All planned structure sites are located in the Austin, excepting Sites 55 and 56 which are located on the outcrop of the Taylor.

The Austin consists of white, chalky limestones in beds of varying thickness, with interbedded layers of marls and clays. Soils are predominantly classified as CL, with lesser amounts of gravelly CL, CH, and GC. Foundation drainage measures may be necessary on sites with steep limestone contacts on the abutments. Site foundations with permeable zones of

gravelly clays and weathered limestone at shallow depths may require foundation trenches through these zones into limestone.

Preliminary estimates of percentages of rock excavation in emergency spillway areas are:

Site Number	Percent Rock
1E	70
8B	60
17	25
23	75
51	60
54A	65

No other sites are expected to have rock excavation.

Sites 55 and 56 are located on the outcrop of the Taylor Marls and clays. Embankment materials are abundant and classified as CL, with some gravelly CL and CH. No seepage problems are expected. Emergency spillway excavation is classified as common and may be used as embankment materials.

All these geologic factors were considered in arriving at construction costs.

Detailed investigations, including exploration with core drilling equipment and field permeability tests, will be made at all sites prior to their construction. Laboratory tests will be performed to determine the suitability and handling of embankment and foundation materials.

Economic Investigations

Determination of Damages

Damage schedules were taken within each reach of the flood plain from landowners and operators. Approximately 50 schedules, covering 25 percent of the flood plain were taken to update the information collected when the original plan was prepared. Information collected was used to determine land use and crop distribution, yield data, expected changes in land use after installation, flood damages to crops and pasture, other agricultural damage, and historical information on flooding. Information from these schedules plus information from local agricultural workers was used as basis for making the necessary estimates used in the economic evaluations.

Flood plain land use was mapped in the field. Enough differences were found in land use and flood frequencies between the upper and lower parts of the main stem and between the major tributaries that the flood plain was left divided into the 10 reaches (figure 7), each with its own damageable value and flood history.

The percent of damages by depths of flooding on crops and pastures was based on the averages given in Fort Worth Engineering and Watershed Planning Unit Technical Letter EWP-E-5. "Historical series" method of calculation of damages was used.

Damage to agricultural property, such as fences, livestock, farm roads, and equipment, and the cost of removal of trash from fields, was estimated from information collected in the field. Road and bridge damages were based on the county commissioners estimate used in the 1956 plan. Some adjustments in values were made.

The value of the physical damage to the flood plain from scour and deposition of sediment was based on the value of production lost. Scour damage was related to depth of flooding, with weight given to increased velocity from the deeper flows.

Indirect damages involve such items as additional travel time for farmers in transporting products and farm equipment, delay of school buses and mail deliveries, costs of extra feed for livestock, loss of benefits from grazing crop aftermath by livestock, and other like items. Based on information obtained and data from other watersheds previously analyzed, it was decided to use 10 percent of the direct damages for this estimate.

Floodwater, scour and sediment, and indirect damages were calculated under the following conditions: without project; with land treatment; with land treatment and floodwater retarding structures; and with land treatment, floodwater retarding structures and stream channel improvement on Wilson Creek and East Fork main stem. The difference between the average annual damages of each increment of protection constitutes the benefits assigned to that increment. Benefits were assigned to each floodwater retarding structure on basis of drainage area of structure.

Crop and pasture damages were calculated from the combined effects of area inundated and depths of inundation.

The occurrence of more than one flood in a growing season was considered in determining crop and pasture damages, which were discounted for the recurrence with some allowance for recovery between floods.

Alternate channel designs were evaluated.

Evaluation of the damage by sediment accumulation in the Lavon Reservoir was made by straight-line depreciation on the construction cost adjusted to long-term level. The value per acre-foot was obtained by dividing the cost of the reservoir by the acre-feet of storage in the reservoir. The benefits were allocated to the various reaches according to the amount of sediment storage contained in the floodwater retarding structures of each reach.

Determination of Annual Benefits from More Intensive and Changed Land Use of Flood Plain Land

During field investigations, farmers were asked what changes had been made in the use of their flood plain land as a result of past flooding. Farmers were also asked what changes they would make in their use of the flood plain if flooding were reduced by 50 percent or more.

It was found that as a result of past flooding, some cropland has been returned to pasture. Johnsongrass acreage has been allowed to increase. Farmers indicated that when flooding is reduced, timberland would be cleared and this land, plus some of the open pastureland, would be planted with alfalfa and Coastal bermudagrass. Part of the Johnsongrass would be replaced with alfalfa. Some increase in truck crop acreage, especially in the lower part of the flood plain, was indicated. Landowners said they would graze small-grain fields, because fences could be maintained and livestock could be managed.

Farmers' statements were considered along with the land capabilities and the general agricultural economic conditions and trends in making the estimates of benefits from more intensive and changed land use of flood plain lands. Consideration was given to the effect of higher values on the damage from the remaining flooding. Added production, harvesting, associated costs, and added overhead costs were deducted from the increased value of production. Benefits were discounted to allow for a 5-year lag in accrual. Production costs were based on "Economic Evaluation Data of Blackland Prairie" by Engineering and Watershed Planning Unit, dated June 1958. Prices were adjusted to long-term. Intensification program is expected on only about one-third of the flood plain above the area that is inundated at least on an average of once in three years. All reaches share these benefits. The average annual net benefits from this source are estimated to be $88,432 (table B).

Secondary Benefits

Local secondary benefits stemming from the project will be realized by workers, processors, and business establishments in the trade area. These benefits accrue from an increase in need for new fencing, planting materials, equipment, fertilizer, labor, and clearing. New construction of rural homes which stems from an increase in land sales will result from the program.

Secondary benefits were estimated to equal 10 percent of the damage reduction and recreation and municipal water benefits, not including indirect, plus 10 percent of the increase in the costs of additional agricultural production from intensification of the flood plain expected after installation of the project.

Secondary costs were estimated to equal 10 percent of the difference in costs of production of crops grown on the areas used for project installation under present conditions and production expected on these same areas after project installation. Secondary costs were included in the estimate of negative project benefits.

Recreation Benefits

Recreation benefits accruing to multiple-purpose structure site 41 were estimated on a basis of $1.50 value per user-day. The following factors were considered in determining the number of annual user-days.

1. Population within a 25-mile radius of the site.
2. Facilities available at the site.
3. Accessibility of site (Roads leading to site).
4. Recreational capacity.
5. Types of recreation available by seasons.
6. Proposed level of admission charges.
7. Operation and maintenance policies.
8. Competitive recreational developments available.

Visitor-days were estimated to be 10,000 annually.

Municipal Water

Municipal water supply benefits were based on estimated cost of the cheapest alternate single-purpose reservoir providing an equivalent supply.

Appraisal of Land and Easement Values (Negative Project Benefits)

Areas that will be used for project construction and areas inundated were excluded from the damage calculations. Net income from the production to be lost in these areas after installation of the project was compared with the appraised value of the land. It was considered that there would be no production in the sediment pools and improved channels. The land covered by the detention pools and spoils from channel enlargement was assumed to be converted to grassland under project conditions. The annual value of the loss of net income from these areas, plus secondary costs, will not exceed the amortized value of the land; therefore, the easement value was used in economic justification.

Details of Methodology

The evaluation of damages was made by flood routing a historical storm series for the period from 1923 through 1942 (20 years). Details of the procedure used in this method of evaluation are described in the Soil Conservation Service Economics Guide and applicable Economics Memorandums for Watershed Protection and Flood Prevention.

Table A - Basic Recreational Facilities
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Site 41

Item	Unit	Number	Unit Cost	Amount 1/
			(dollars)	(dollars)
1. Roads - Rock Base With Gravel Surface	Mile	2.1	3,367	7,070
2. Parking Lot - 105,000 Square Feet (Rock Base With Gravel Surface)	Each	1	750	750
3. Sanitary Facilities				
a. Single Seat Pit Toilets	Each	2	425	850
b. Double Seat Pit Toilets	Each	4	600	2,400
4. Electrical and Lighting				
a. Boat Docks	Each	1	100	100
b. Picnic Areas	Each	3	100	300
c. Beach	Each	1	300	300
d. Parking	Each	1	100	100
5. Beach Development Sand and Gravel (Pit Run)	Cu. Yd.	750	2	1,500
6. Boat Dock	Each	1	500	500
7. Boat Ramps				
a. Concrete	Each	1	600	600
b. Rock Base With Gravel Surface	Each	1	120	120
8. Picnic Facilities				
a. Tables and Benches, Concrete	Each	13	370	4,810
b. Cooking Fireplace	Each	5	35	175
c. Concrete Slabs (For Garbage Receiver)	Each	5	21	105
d. Parking Spurs - 1 Each per Picnic Table	Each	13	40	520
9. Land				9,245
Total				29,445

1/ Includes administration of contract and installation services.

Supplement September 1963

Table B - Summary of Intensification and Changed Land Use of Flood Plain Land
East Fork Above Lavon Watershed, Texas
(Trinity River Watershed)

Flood Plain Land Use	Unit of Production	Acres	Yield Per Acre	Gross Income	Production Cost	Net Return
				(dollars)	(dollars)	(dollars)
				Without Project		
Cotton	Lb.	851	300	88,875	37,947	50,928
Corn	Bu.	401	56	27,981	10,772	17,209
Wheat	Bu.	673	30	39,965	14,776	25,189
Oats	Bu.	243	50	9,536	5,639	3,897
Barley	Bu.	198	50	9,217	4,169	5,048
Grazing Small Grain	AUM	-	-	-	-	-
Grain Sorghum	Cwt.	533	33	29,728	10,549	19,179
Alfalfa Hay	Ton	397	3.9	44,189	14,037	30,152
Sudan Hay	Ton	202	3.0	14,210	7,362	6,848
Johnsongrass Hay	Ton	1,334	2.9	89,563	37,599	51,964
Truck Crops	Bu.	136	200	37,175	16,910	20,265
Pasture	AUM	1,527	5.5	22,045	7,485	14,560
Woods	-	761	-	-	-	-
Idle	-	78	-	-	-	-
Miscellaneous	-	96	-	-	-	-
Total		7,430		412,484	167,245	245,239
				With Project		
Cotton	Lb.	855	300	89,262	38,110	51,152
Corn	Bu.	404	56	28,186	10,856	17,330
Wheat	Bu.	673	28	37,927	14,677	23,250
Oats	Bu.	243	44	8,349	5,506	2,843
Barley	Bu.	208	41	8,104	4,301	3,803
Grazing Small Grain	AUM	(1,124)	2.5	9,456	-	9,456
Grain Sorghum	Cwt.	526	33	29,437	10,421	19,016
Alfalfa Hay	Ton	1,766	3.9	201,382	63,778	137,604
Sudan Hay	Ton	142	3.0	9,972	5,126	4,846
Johnsongrass Hay	Ton	458	3.0	31,412	13,100	18,312
Truck Crops	Bu.	231	200	69,300	31,185	38,115
Pasture	AUM	1,634	8.4	35,846	8,294	27,552
Woods	-	179	-	-	-	-
Idle	-	15	-	-	-	-
Miscellaneous	-	96	-	-	-	-
Total		7,430		558,633	205,354	353,279

Increased Net Return With Project - 1962 Prices	$ 108,040
Increased Net Return - Long-term Prices	104,826
Discounted Increased Net Return (5 Years at 4 percent)	94,696
Less Associated Costs 1/	6,264
Average Annual Benefits	$ 88,432

1/ Includes cost of clearing, pasture plantings, added fencing, increased taxes and overhead, and additional damage from remaining flooding on higher value crops.

September 1963

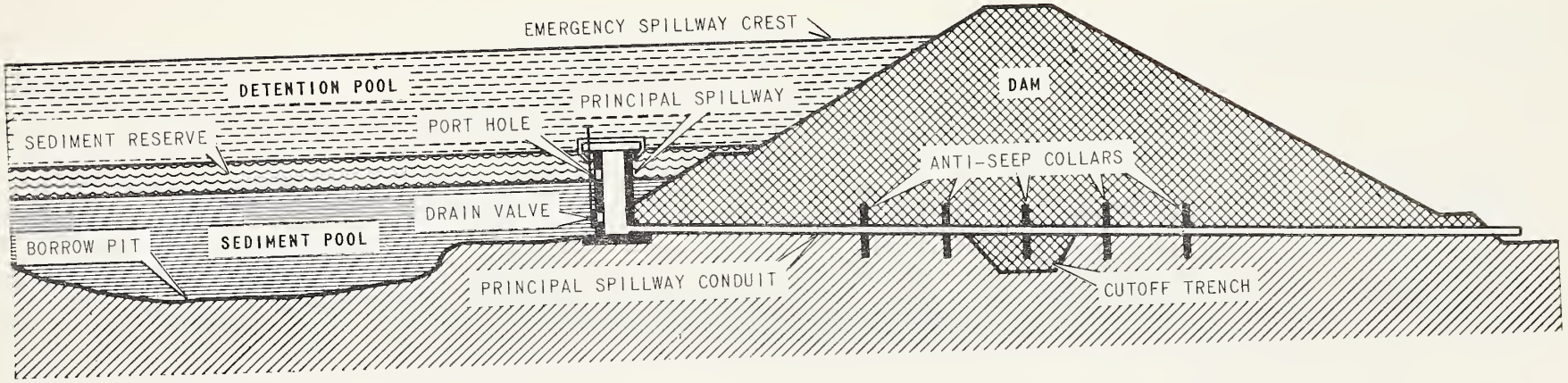


Figure 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

Revised 10-31-60 4-L-10,071

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

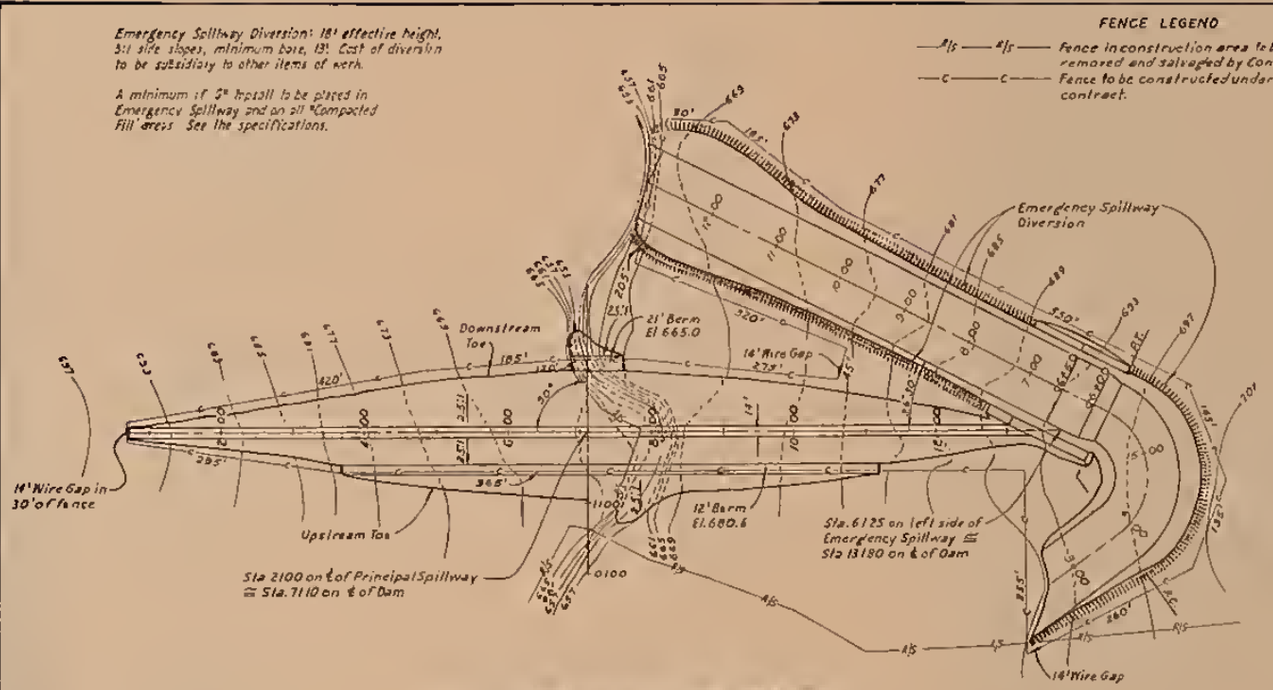
Emergency Spillway Diversion: 18' effective height, 3:1 side slopes, minimum base, 13'. Cost of diversion to be subsidiary to other items of work.

A minimum of 2" topsoil to be placed in Emergency Spillway and on all Compacted Fill areas. See the specifications.

FENCE LEGEND

—R/S—R/S— Fence in construction area to be removed and salvaged by Contractor.

—C—C— Fence to be constructed under this contract.



PLAN OF EMBANKMENT AND SPILLWAYS

0 100 150 200 400 600

SCALE IN FEET

EMERGENCY SPILLWAY CURVE DATA

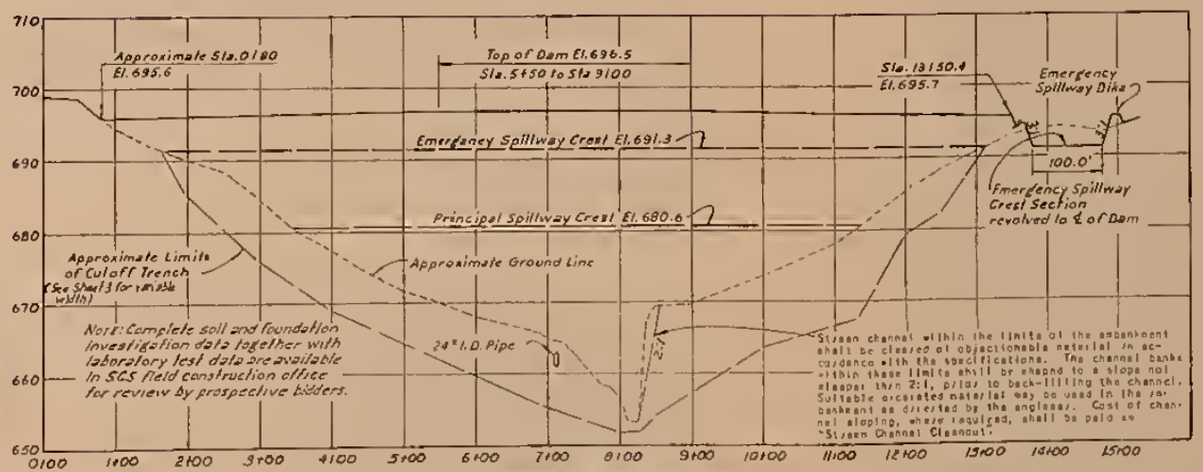
Δ = 114°48'
D = 26°00'
R = 102.31'
L = 205.0'
P.C. = Sta 3175
P.T. = Sta 5180

Structure Site No. 10-A, located 7 miles west and 2 miles north of McKinney, Collin County, Texas.

VICINITY MAP

0 1 2 3

SCALE IN MILES



PROFILE ON ℄ OF DAM

Figure 2

TYPICAL

FLOODWATER RETARDING STRUCTURE

GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed S.M.B.	3-63	Approved by	
Drawn D.L.E. & S.M.B.	3-63		
Traced M.G.C.	4-63		
Checked S.M.B. & W.T.	4-63	Sheet No. 2 of 8	4-E-17,783

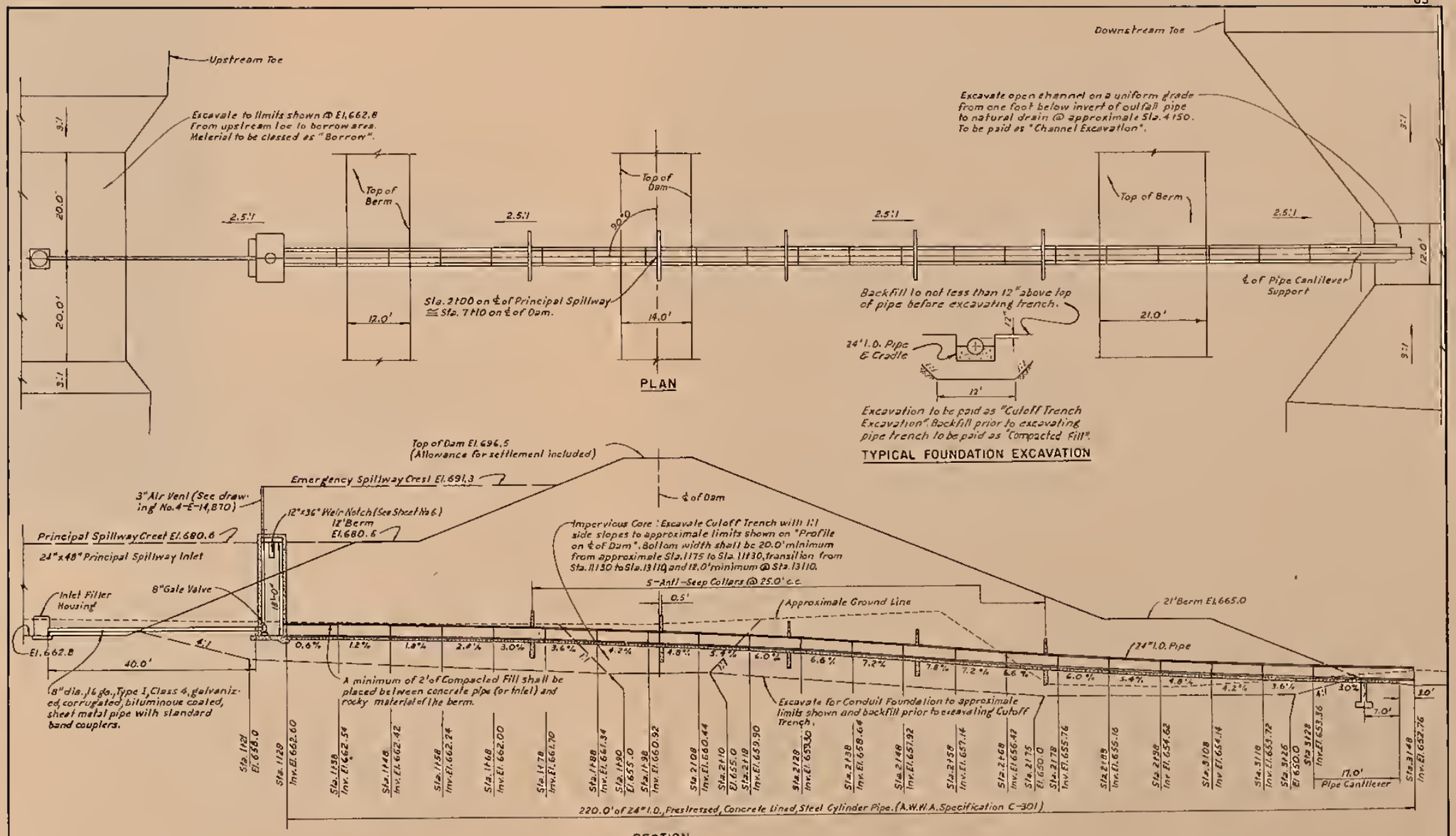


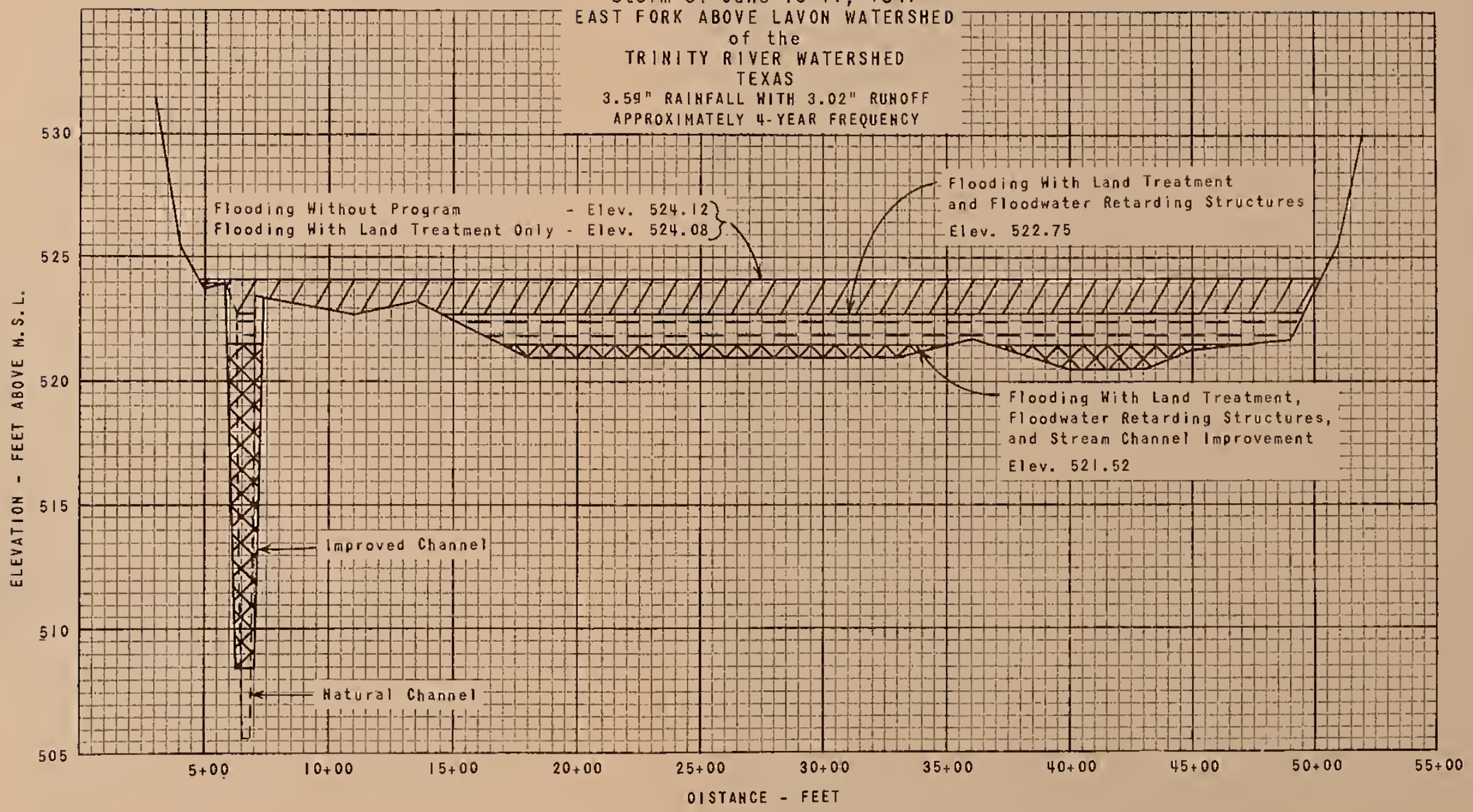
Figure 2A
TYPICAL
FLOODWATER RETARDING STRUCTURE
PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed S.M.B.	Date 3-63	Approved by	
Drawn S.M.B.	3-63		
Traced M.G.C.	4-63	Work Unit Title	
Checked S.M.B. & G.W.T.	4-63	Sheet No. 4 of 8	Drawing No. 4-E-17,783

Figure 3

DEGREE OF FLOOD REDUCTION
Storm of June 10-11, 1941
EAST FORK ABOVE LAVON WATERSHED
of the
TRINITY RIVER WATERSHED
TEXAS
3.59" RAINFALL WITH 3.02" RUNOFF
APPROXIMATELY 4-YEAR FREQUENCY

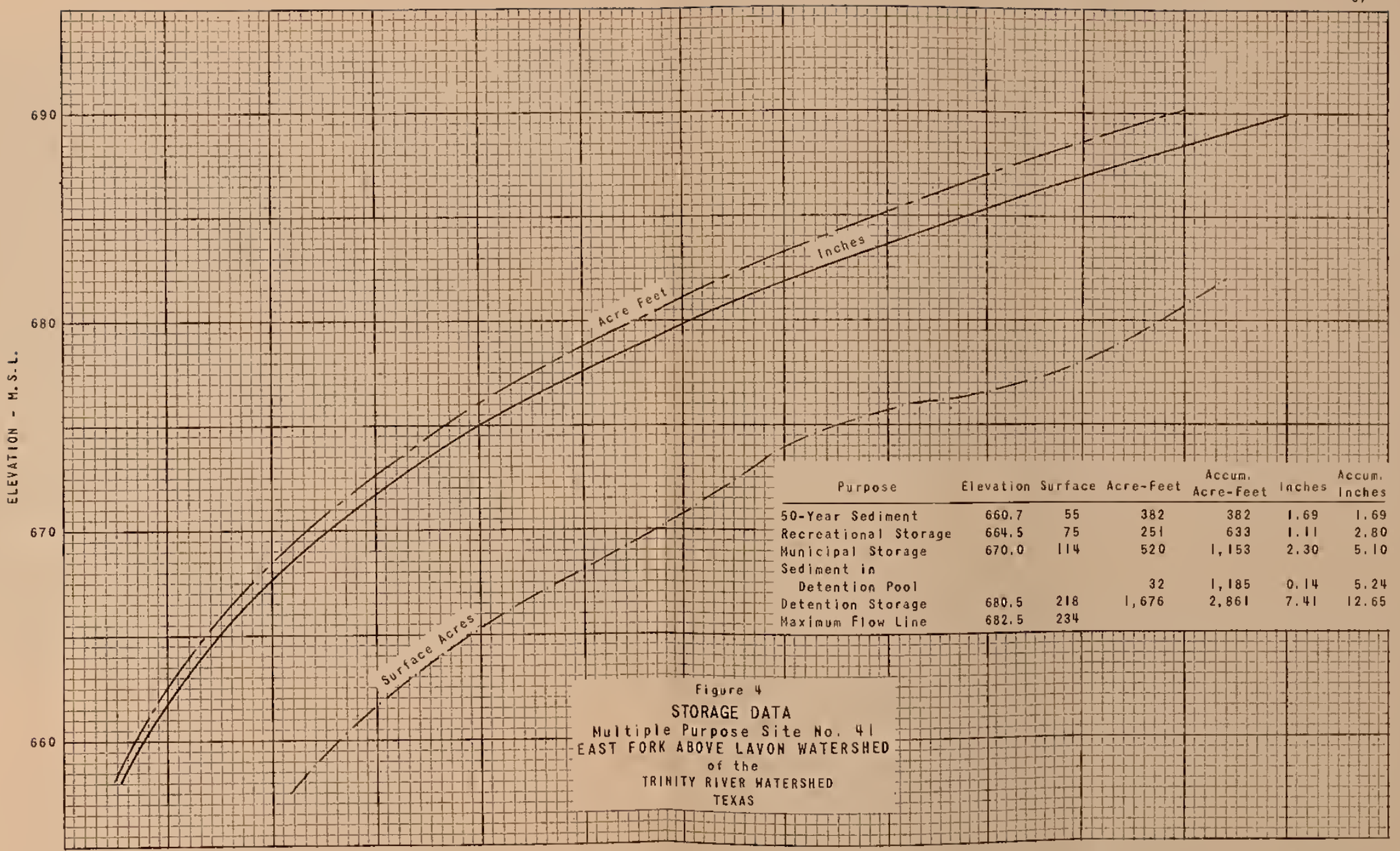


VALLEY CROSS SECTION NO. 6E

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas

2-64 4-R-18634

4-7142 2-64



Purpose	Elevation	Surface	Acre-Feet	Accum. Acre-Feet	Inches	Accum. Inches
50-Year Sediment	660.7	55	382	382	1.69	1.69
Recreational Storage	664.5	75	251	633	1.11	2.80
Municipal Storage	670.0	114	520	1,153	2.30	5.10
Sediment in Detention Pool			32	1,185	0.14	5.24
Detention Storage	680.5	218	1,676	2,861	7.41	12.65
Maximum Flow Line	682.5	234				

Figure 4

STORAGE DATA

Multiple Purpose Site No. 41

EAST FORK ABOVE LAVON WATERSHED

of the

TRINITY RIVER WATERSHED

TEXAS

Surface (Acres)	20	40	60	80	100	120	140	160	180	200	220	240	260
Acre-Feet	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
Inches	2	4	6	8	10	12	14	16	18	20	22	24	26

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas

2-64 4-R-18635

4-7142 2-64

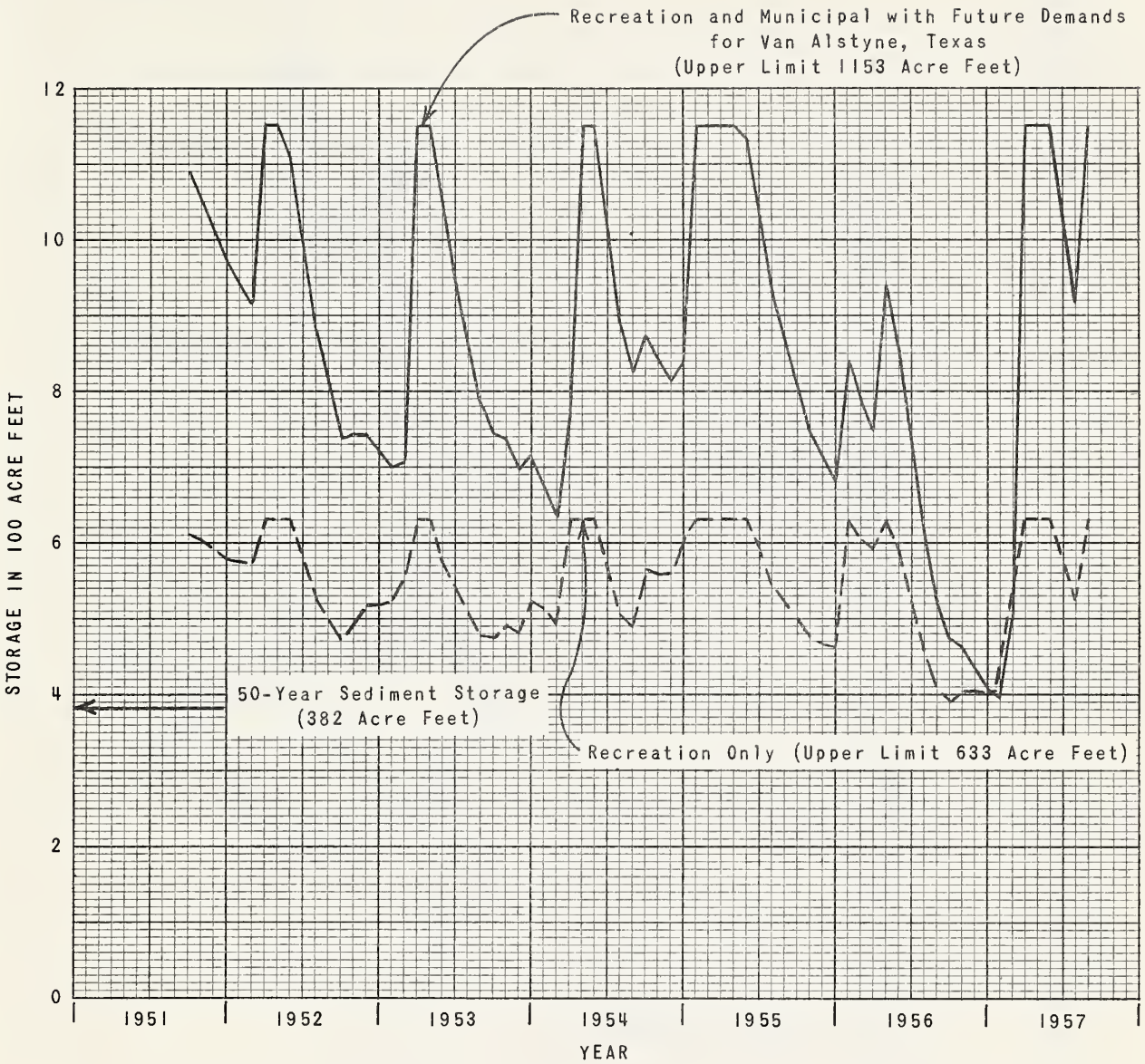


Figure 5

RESERVOIR OPERATION STUDY
Multiple Purpose Site No. 41
EAST FORK ABOVE LAVON WATERSHED
of the
TRINITY RIVER WATERSHED
TEXAS

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple Texas 2-64 4-R-18636

4-7142 2-64

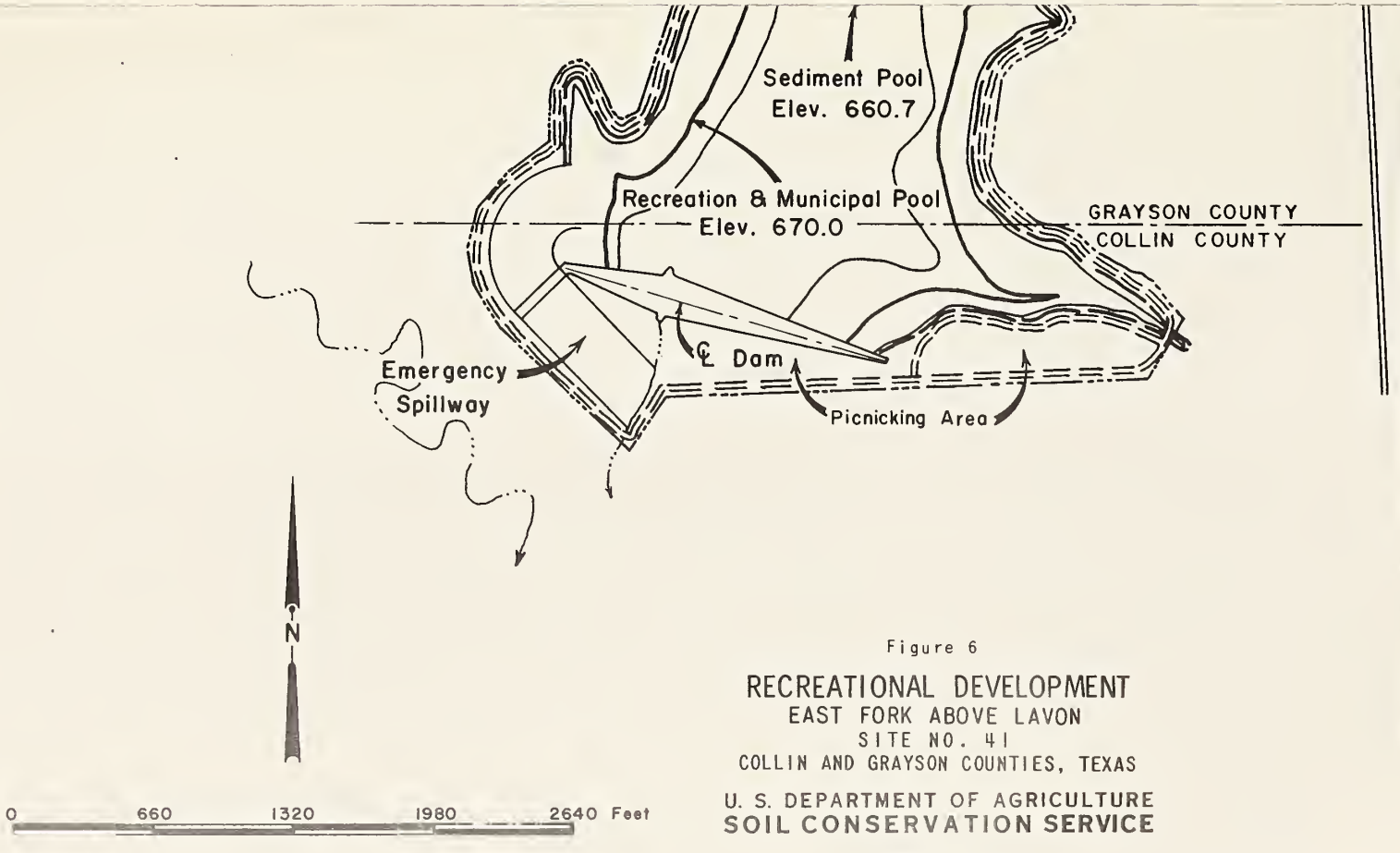


Figure 6

RECREATIONAL DEVELOPMENT
EAST FORK ABOVE LAVON
SITE NO. 41
COLLIN AND GRAYSON COUNTIES, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TEMPLE, TEXAS

2-64 4-R-18668

VICINITY MAP

LEGEND

- Recreationol Areo Boundory
- County Line
- Hord Surface Rood
- Dirt Road
- Access Rood
- Power Line
- Boat Romp
- Boat Dock

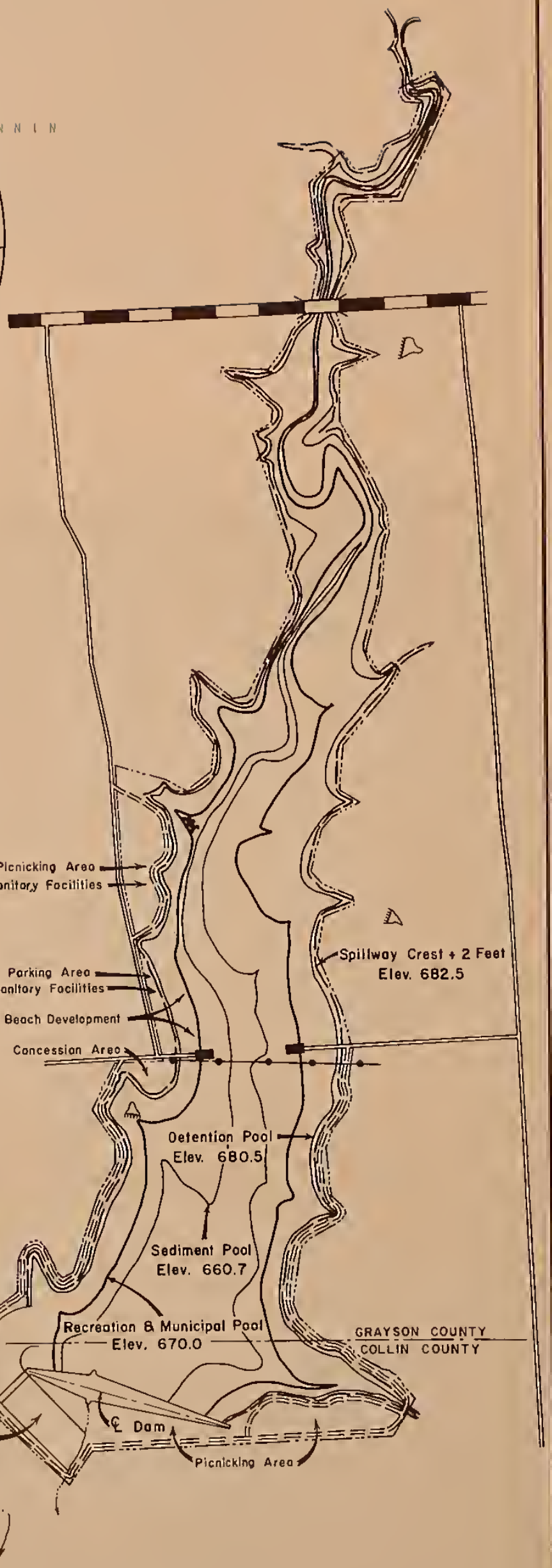


Figure 6

RECREATIONAL DEVELOPMENT
EAST FORK ABOVE LAVON
SITE NO. 41
COLLIN AND GRAYSON COUNTIES, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TEMPLE, TEXAS

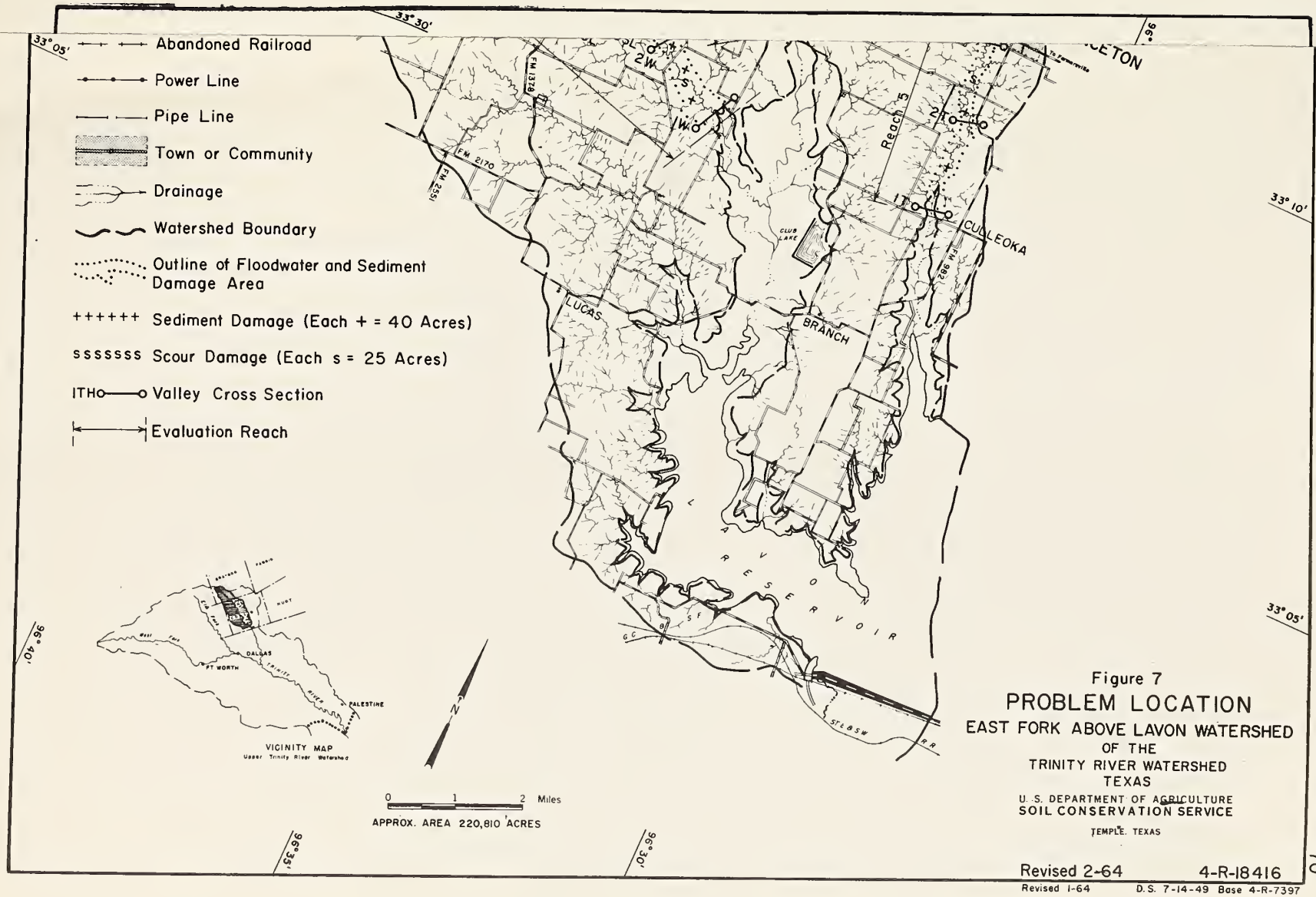


Figure 7

PROBLEM LOCATION

EAST FORK ABOVE LAVON WATERSHED
OF THE
TRINITY RIVER WATERSHED
TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

Revised 2-64 4-R-18416
Revised 1-64 D.S. 7-14-49 Base 4-R-7397

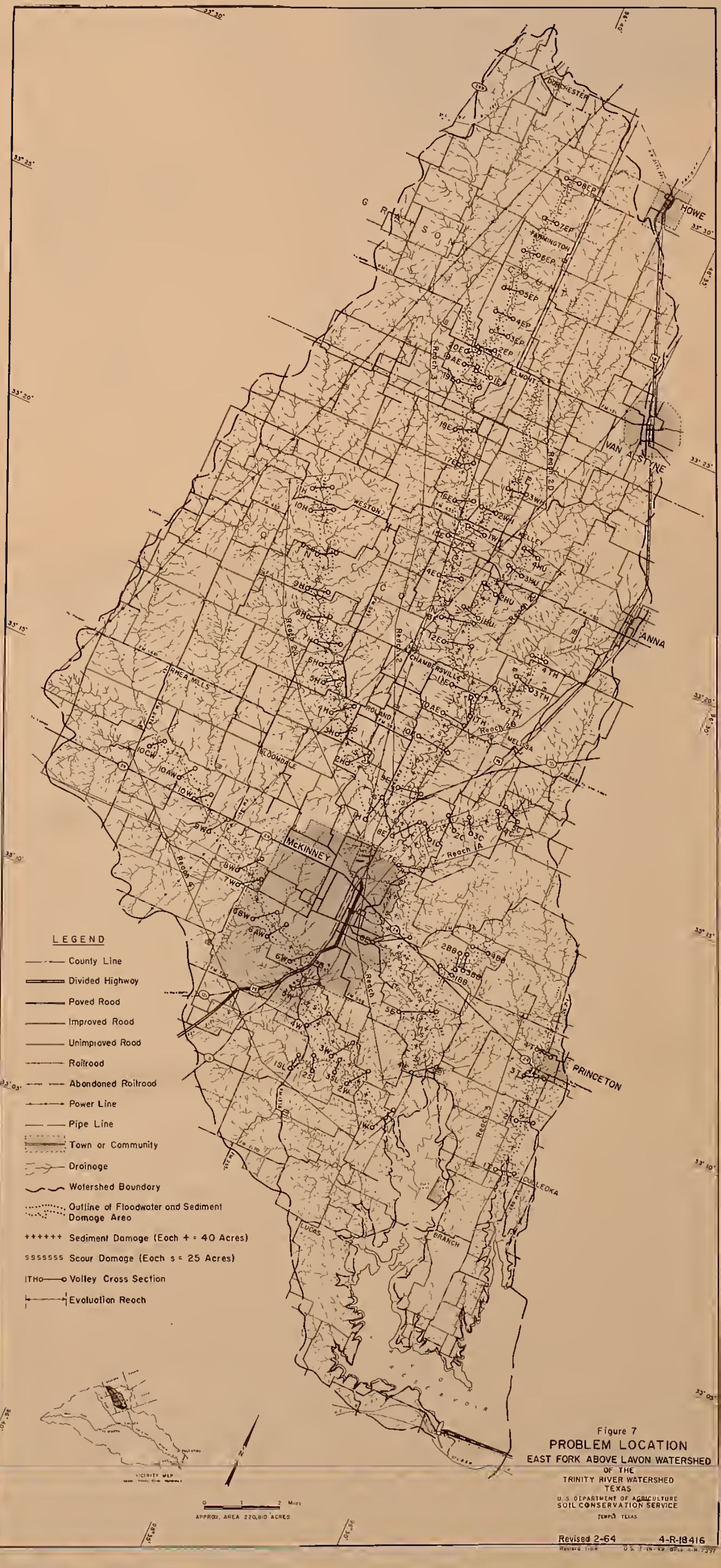


Figure 7

PROBLEM LOCATION

EAST FORK ABOVE LAVON WATERSHED OF THE TRINITY RIVER WATERSHED TEXAS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

Revised 2-64 4-R-18416

Revised 1-64 U.S. 7-14-62 GPO 4-R-7397

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Site Numbers and Drainage Areas in Acres

No.	Area	No.	Area	No.	Area
1A	764	10	880	32A	338
1B	1312	11	1455	33	820
1C	1528	12	923	34	706
10A	992	13	536	35	706
1E	3776	14	700	35A	1888
2A	4112	15	832	36	276
2B	650	16	880	37	516
3A	488	17	858	38	420
3B	1684	18	1659	38A	3017
3C	915	19	981	39	4003
3D	630	20	784	41	2714
3E	314	21	320	42	3821
4	2374	22	286	43	1524
5A	1220	23	6150	44	396
6A	1254	24	887	45	608
6B	2196	26	2438	46	2165
8A	2376	26A	478	47	2153
8B	2096	26B	440	48	588
8C	1344	27	740	50	3758
8D	936	28	499	51	700
8E	1236	29	833	52	880
8F	954	29A	320	53	736
8G	2532	30	592	54A	1075
8H	1393	31	619	55	3175
9	855	32	813	56	1460

LEGEND

- County Line
- Divided Highway
- Paved Road
- Improved Road
- Unimproved Road
- Railroad
- Abandoned Railroad
- Power Line
- Pipe Line
- Town or Community
- Drainage
- Watershed Boundary
- Floodwater Retarding Structure (Completed)
- Floodwater Retarding Structure
- Multiple-Purpose Structure (M & R Municipal and Recreation)
- Area Benefited
- Drainage Area Controlled by Structure
- Channel Improvement
- (65) Site Number

VICINITY MAP

APPROX. AREA 220,810 ACRES

Figure 8

PROJECT MAP

EAST FORK ABOVE LAVON WATERSHED
OF THE
TRINITY RIVER WATERSHED
TEXAS

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

Revised 2-64

4-R-18417

Revised 1-64 D.S. 7-14-49 Base 4-R-7397

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